

# BYTE

THE WORLDWIDE COMPUTING AUTHORITY



**19 Removable Drives**  
Page 198

## Take the Express Lane

**VL-Bus, QuickRing  
and PCI raise  
the speed limit**

**4 New Low-Cost Macs**

**Compaq's Newest  
Notebooks**

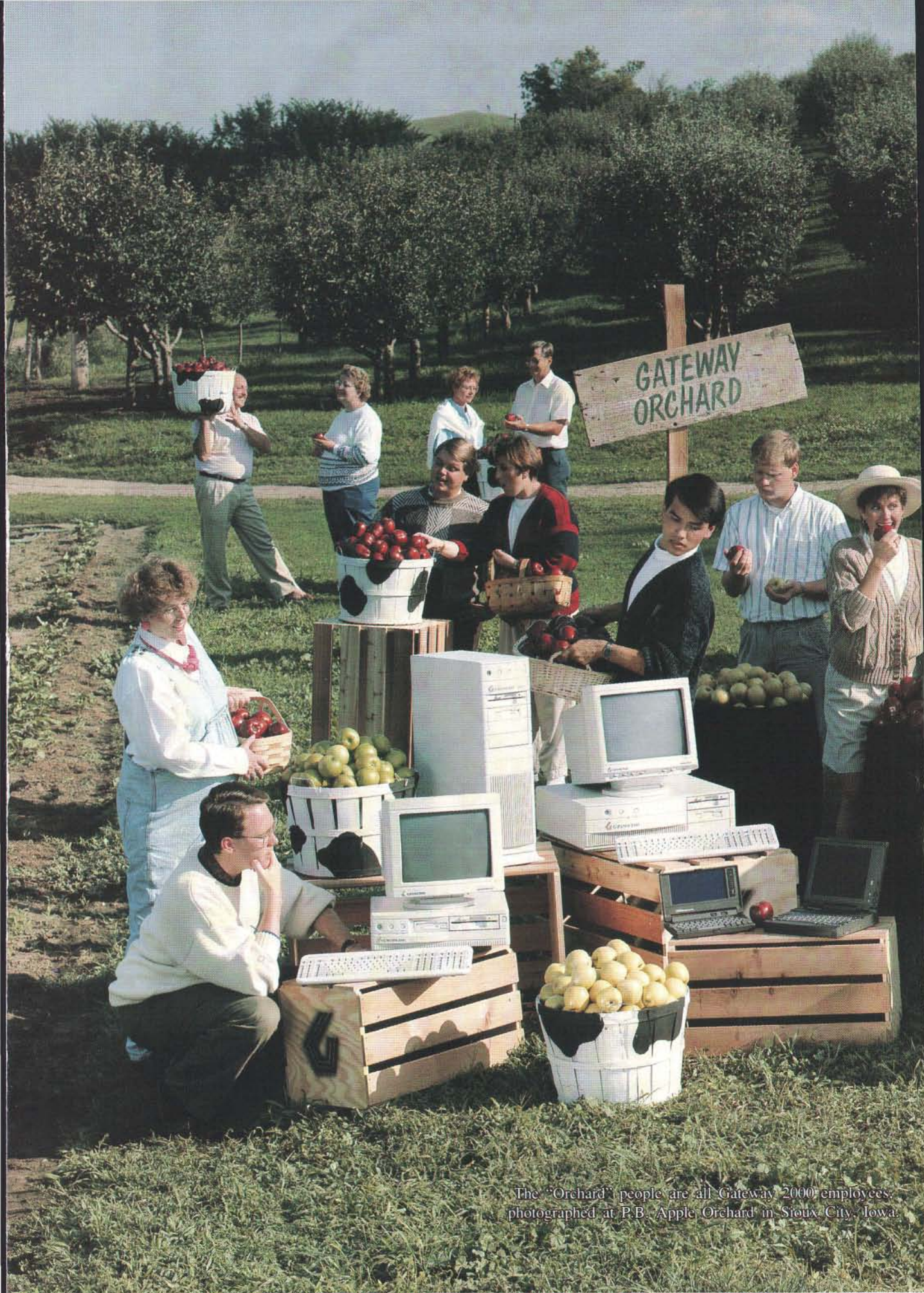
**BYTE Pushes  
12 File Servers  
to the Limit**

International Edition



£1.95 U.K./Lit.8.000 ITALY/\$3.50 U.S.A.  
A McGraw-Hill Publication/0360-5280





The "Orchard" people are all Gateway 2000 employees, photographed at P.B. Apple Orchard in Sioux City, Iowa.



# APPLES TO APPLES, YOU CAN'T BEAT GATEWAY 2000!

With all the price paring going on in the industry, the PC crop looks luscious — but now, more than ever, it's important to compare apples to apples. You can look at two 486SX machines and actually be comparing an apple to an orange. What's inside makes a big difference. Other manufacturers do whatever it takes to hit a price point, and what you thought was a peach may turn out to be a lemon.

The trick is to weed through PC manufacturers to find the one that's perfected the recipe. You need the right ingredients mixed together in just the right way: the smartest

system features, quality components, the company's strength and a reputation for the best, most knowledgeable service.

We'd like to share this recipe to help you peel away the hype and compare performance and features. Apples to apples, you'll find Gateway 2000 is the only company where a bushel is still a bushel. And a dollar buys more today than it did yesterday. That's value. That's the Gateway 2000 difference.

## Performance

### CPUs

- \* Preset your PC for tomorrow's software by choosing a 486 system — 486 CPUs are designed for power-hungry applications.
- \* Check for memory cache for optimal processor and memory performance. 64k is your best choice.

### Drives

- \* Avoid slow cooking — make sure your access time is less than 15ms.
- \* Blend in at least 32k of cache.
- \* RIDE (Rapid Integrated Drive Electronics), Gateway's exclusive disk performance enhancement, will spice up your performance even more.

### Video

- \* To serve up the best Windows performance, look for coprocessed video.

- \* VRAM vs. DRAM: Don't settle for stale ingredients — VRAM is faster. Remember, add at least 1MB RAM.
- \* Add a local bus video for the best video performance, but avoid proprietary local buses.

## Features

### RAM

- \* For the best results, start out with a minimum of 4MB. We recommend 8MB.
- \* Make sure your machine is expandable to at least 16MB, but look for upgradability to 64MB.

### Drives

- \* Stir in a bare minimum of 80MB.
- \* Add both 5.25" and 3.5" floppies.

### Monitors

- \* Start out with a 14-inch, 1024 x 768 NI color monitor.
- \* Upgrade to a 15-inch color monitor with a flat, square, non-glare screen for a larger, brighter viewing area.

## Software

- \* Your system should include Microsoft® DOS® 5.0 and MS Windows™ 3.1, installed and ready to run.
- \* Toss in your choice of free applications software options preinstalled.

## Keyboard

- \* Add a programmable keyboard with more than 101 keys. Mix in two sets of function keys.

## Company

- \* With Gateway 2000, you get a financially sound, proven company with one of the best balance sheets in the industry.

- \* Combine Midwestern work ethics and ingenuity with liberal amounts of buying power to bring you the latest technology at an unbeatable price.









THIS IS OUR IDEA  
OF A GOOD DEAL.





# ADDED TEMPTATIONS FROM GATEWAY 2000

## Nomad Notebooks

Our small, lightweight Nomad notebook PCs give you desktop performance no matter where you are.

*PC Magazine* reports, "Geared to low power consumption, Gateway 2000's Nomad line offers excellent battery life, light weight, quality performance, and a highly competitive price."

*Computer Shopper* added, "The Nomad is far and away the best laptop around for getting the maximum value out of a single battery charge."

"...(it's) clearly the best general-purpose choice (for a notebook computer)."

And our 486 Nomads don't sacrifice performance for portability. You get a bushel basket full of standard features!



## The HandBook™

Sometimes a product is so special, it's impossible to compare it to anything else. And that's the way it is with our one-of-a-kind HandBook — a real PC in miniature form!

It weighs just 2.75 pounds and measures 6 x 9 inches. Yet it delivers 286-class performance and speedily runs all your favorite DOS applications with a bright backlit screen, a bonafide 40MB hard drive and a comfortable 78-key keyboard (no chiclet keys). And you get up to 4.5 hours battery life with power management.

Your HandBook arrives with MS-DOS® 5.0, LapLink® XL from Traveling Software, MS PC Works™, and Central Point® Desktop. A serial cable is included for downloading to your desktop.

## An Extra Slice For Gateway Customers

### Free Application Software

It's ripe for the picking at Gateway 2000! Each Nomad comes with MS Works™, and each 486 desktop or tower system comes with your choice from the option list on the next page.

### The 15-Inch CrystalScan 1572FS

A flat, square, non-glare screen reduces distortion around the corners and provides edge-to-edge display — an upgrade option with the purchase of a 386DX or 486 for an additional \$195.

### The Gateway 2000 TelePath™ Fax/Modem

A 14,400 bps mode, V.32bis, with 9,600 bps fax capability. Includes WinFax Pro™, Crosstalk for Windows™, Qmodem™ and a free 30-day basic services CompuServe® membership — all for only \$195!

### More Software At Great Prices

Central Point® Anti-Virus 1.2 for Windows \$75

Central Point Backup™ 7.2 for Windows \$75

The Norton Desktop™ 2.0 and Prisma YourWay 2.0 for Windows (personal information manager) \$95

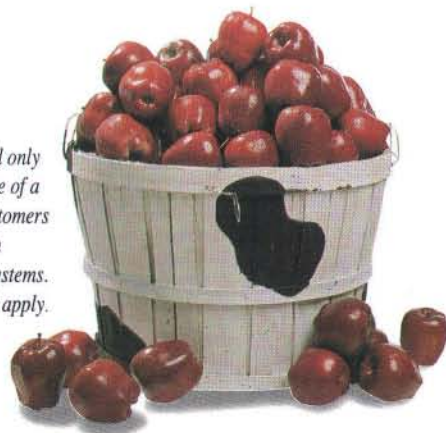
Also available — tape backups, printers and other peripherals. Call for details.

### The Extras — That Don't Cost Extra

- One-year limited warranty
- 30-day money-back guarantee
- Free on-site service to most locations (factory service only for notebooks)
- Lifetime toll-free technical support
- Free BBS lifetime membership
- Payment options — major credit cards and C.O.D. terms; net 30-day credit terms and leasing options are available to qualified commercial customers.

Software options include identical applications contained in retail packages but will not include the retail box. You get all master diskettes and manuals, shrink-wrapped and packaged in a Gateway 2000 box.

Components, peripherals and software are sold only with the purchase of a system, or to customers who already own Gateway 2000 systems. Some limitations apply.





## PORTABLES

### HANDBOOK™

- 286 Class Performance
- 1MB RAM upgradeable to 3MB
- 40MB Hard Drive
- Backlit 7.6" CGA Screen
- Size 5.9" x 9.75" x 1.4", 2.75 Lbs.
- 4.5-Hr.\* NiMH Battery & AC Pack
- 1 Parallel/1 Serial Port
- 78-Key Keyboard
- MS DOS 5.0, LapLink XL, MS Works, Central Point Desktop & Serial Download Cable
- Carrying Case

**\$1295**

### NOMAD 325SXL

- 25MHz, 386SXL Processor
- 4MB RAM
- 1.44MB 3.5" Drive
- 80MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 256K
- Size 8.5" x 11" x 1.8", 5.8 Lbs.
- 6-Hr.\* NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard
- FieldMouse™ Pointing Device
- MS DOS® 5.0 and Windows™ 3.1
- MS Works™ for Windows

**\$1995**

### NOMAD 420SXL

- 20MHz, Intel® 486SXLP Processor
- 4MB RAM
- 1.44MB 3.5" Drive
- 80MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 1MB
- Size 8.5" x 11" x 1.8", 5.8 Lbs.
- 6-Hr.\* NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard
- FieldMouse Pointing Device
- MS DOS 5.0 and Windows 3.1
- MS Works™ for Windows

**\$2495**

### NOMAD 425DXL

- 25MHz, Intel 486DXLP Processor
- 4MB RAM
- 1.44MB 3.5" Drive
- 120MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 1MB
- Size 8.5" x 11" x 1.8", 5.8 Lbs.
- 6-Hr.\* NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard
- FieldMouse Pointing Device
- MS DOS 5.0 and Windows 3.1
- MS Works™ for Windows

**\$2995**

## DESKTOPS

### 25MHz 386SX

- Intel 386SX Processor
- 4MB RAM
- 1.2MB & 1.44MB Drives
- 80MB 15ms IDE Cache Drive
- 16-Bit SVGA with 1MB
- 14" CrystalScan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey™ Keyboard
- Microsoft® Mouse
- MS DOS 5.0 and Windows 3.1
- MS Works™ for Windows

**\$1345**

### 25MHz 486SX

- Intel 486SX Processor
- 4MB RAM
- 1.2MB & 1.44MB Drives
- 120MB 13ms IDE\*\* Cache Drive
- ATI™ Graphics Ultra with 1MB
- 14" CrystalScan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0 and Windows 3.1
- Choice of Application Software

**\$1795**

### 33MHz 486DX

- Intel 486DX Processor
- 64K Memory Cache
- 4MB RAM
- 1.2MB & 1.44MB Drives
- 200MB 13ms IDE\*\* Cache Drive
- ATI Graphics Ultra with 1MB
- 14" CrystalScan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0 and Windows 3.1
- Choice of Application Software

**\$2295**

### 50MHz 486DX2

- Intel 486DX2 Processor
- 64K Memory Cache
- 8MB RAM
- 1.2MB & 1.44MB Drives
- 200MB 13ms IDE\*\* Cache Drive
- ATI Graphics Ultra with 1MB
- 14" CrystalScan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0 and Windows 3.1
- Choice of Application Software

**\$2595**

### 66MHz 486DX2

- Intel 486DX2 Processor
- 64K Memory Cache
- 8MB RAM
- 1.2MB & 1.44MB Drives
- 340MB 13ms IDE\*\* Cache Drive
- Ultra Fast Local Bus Video
- 15" CrystalScan 1572 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0 and Windows 3.1
- Choice of Application Software

**\$2995**

### 66MHz 486DX2 EISA

- Intel 486DX2 Processor
- 128K Memory Cache
- 8MB RAM
- 1.2MB & 1.44MB Drives
- 340MB 15ms SCSI Cache Drive
- 32-Bit EISA SCSI Controller
- 16-Bit SVGA with 1MB
- 14" CrystalScan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0 and Windows 3.1
- Choice of Application Software
- Tower Model is Standard

**\$3995**

### SOFTWARE CHOICES

- Microsoft® Excel for Windows™ 4.0
- MS Word for Windows™ 2.0
- MS PowerPoint for Windows™ 3.0
- MS Project for Windows™ 3.0
- Borland Paradox® 4.0 and Turbo Pascal 1.5 or C++® 3.1
- The MS Entrepreneur Pack (Works™, Publisher™, Money™ and Games)
- The Windows Programmer Pack (MS QuickC™, Visual Basic, and More)
- MS Office™ (Word, Excel, and PowerPoint) Available as an upgrade replacing any above option.



Printed on recycled paper.

\*\*Enhanced IDE with RIDE (Rapid Integrated Drive Electronics)

\* Battery life was measured using PC Magazine's Battery Runtown Test with power management enabled. Actual results may vary.



8 0 0 - 5 2 3 - 2 0 0 0

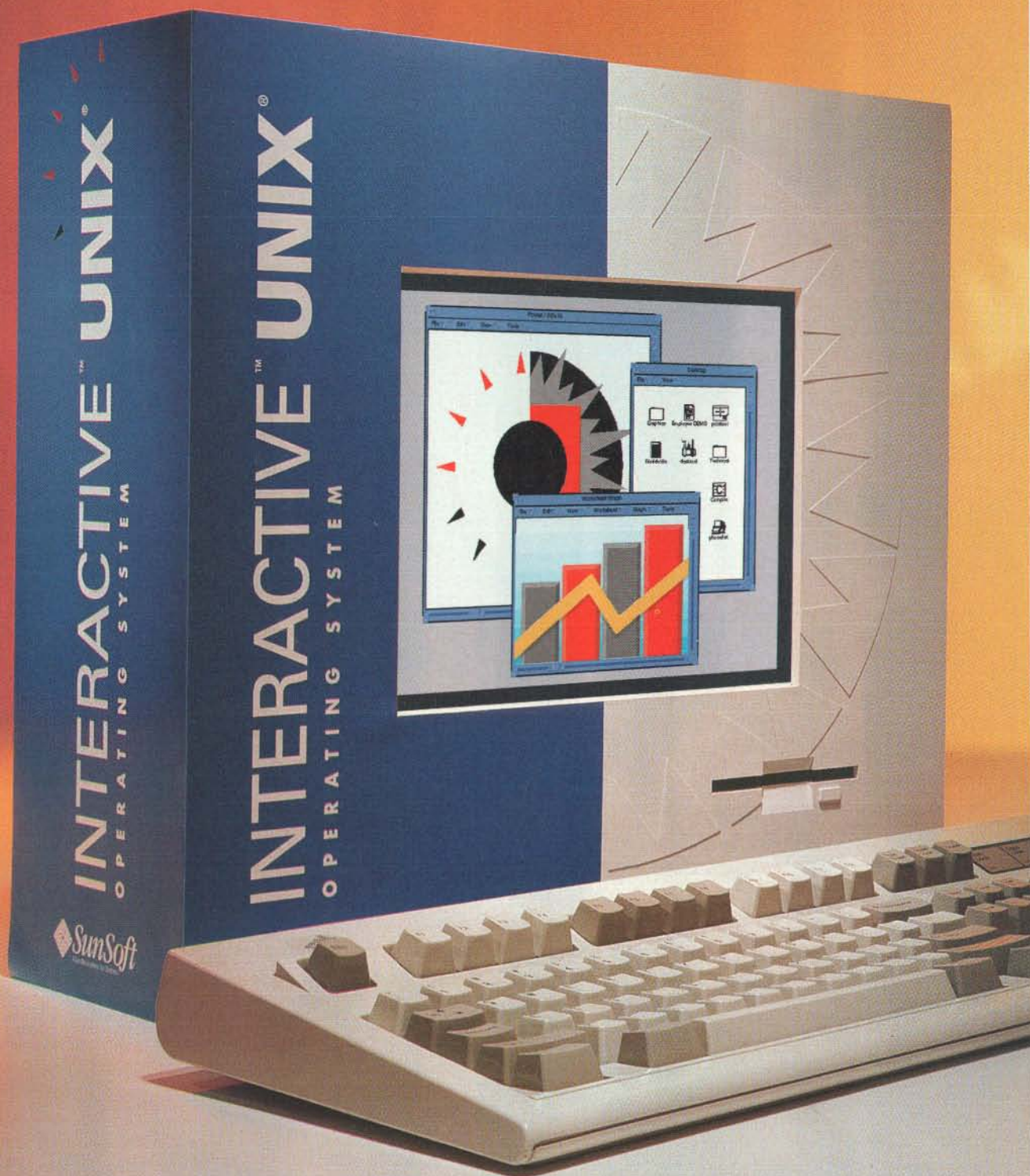
610 Gateway Drive • P.O. Box 2000 • North Sioux City, SD 57049-2000 • 605-232-2000 • Fax 605-232-2023

Sales Hours: 7am-10pm Weekdays, 9am-4pm Saturdays (CDT)

© 1992 Gateway 2000, Inc. AnyKey, HandBook, FieldMouse and TelePath are trademarks of Gateway 2000, Inc. Intel is a trademark of Intel Corporation. All other brands and product names are trademarks or registered trademarks of their respective companies. All prices and configurations are subject to change without notice. Prices do not include shipping.









# So Powerful It Can't Be A PC.

## Transform Your PC With The INTERACTIVE UNIX System.

Unleash the 32-bit power in your PC with the INTERACTIVE™ UNIX® System from SunSoft. Charge through applications at record speeds. Use real-world multitasking and networking. Get on the path to a distributed computing future.

### Just Say No To SCO.

Why? The INTERACTIVE UNIX System is easy to use, simple to administer, all at a great price.

*Open Systems Today\** says the INTERACTIVE UNIX "system management...is easier to use and more comprehensive" than SCO™ and "is simply a masterpiece of good design."

Looking Glass Professional™ desktop manager makes the INTERACTIVE UNIX System easy enough for novices, yet powerful enough for experienced UNIX users. And the award winning Easy Windows makes setting up graphic environments infinitely simpler.

You can't afford *not* to take advantage of the already low cost of the INTERACTIVE UNIX System.

And SCO UNIX/XENIX® users can save an additional 50% by switching to the INTERACTIVE UNIX System today. That's something to say yes to.



## Everything You Like About Your PC—And A Lot More.

INTERACTIVE UNIX System V/386 Release 3.2 supports hundreds of the most popular Intel-based platforms and peripherals. So getting started is fast, easy, and cost-effective.

Thousands of UNIX and XENIX applications are at your command. And our VP/ix package runs virtually all DOS software.

You get Lotus™, WordPerfect®, and Oracle®. You get SCO applications. You get it all.

### See What Develops.

The INTERACTIVE UNIX System is the environment of choice for 80X86 application development. You get access to a full range of development tools including compilers, debuggers and libraries. And for graphical applications, the X11 INTERACTIVE environment is a revelation.

### Partner With Power.

The INTERACTIVE UNIX System is a powerful business partner for companies who know something about power. Companies like BMW, Goodyear, Leica, and Dunlop to name a few. That power can be yours, too. All from SunSoft, the leading supplier of 32-bit UNIX system software.

Call today and save 50% on UNIX power that's so cost-effective, it can't be anything *but* a PC. 1-800-227-9227.

See SunSoft at UNIXExpo, Booth 1219

 **SunSoft**  
A Sun Microsystems, Inc. Business

\*Issue date: April 13, 1992. © 1992 Sun Microsystems, Inc. Sun, Sun Microsystems, the Sun logo, SunSoft, the SunSoft logo, VP/ix and Easy Windows are trademarks or registered trademarks of Sun Microsystems, Inc. INTERACTIVE is a trademark of INTERACTIVE Systems Corporation. UNIX is a registered trademark of UNIX System Laboratories, Inc. Looking Glass Professional is a trademark of Visix Software, Inc. All other trademarks and registered trademarks are the properties of their respective holders. The promotional discount is available to SCO UNIX/XENIX users and is subject to certain restrictions. Contact SunSoft for terms and conditions of promotion. SunSoft reserves the right to stop the promotion at any time. SunSoft can be reached at 3550 Garcia Avenue, Mountain View, CA 94043, (510) 460-3267.

B10/92

Circle 209 on Inquiry Card.



## COVER STORY

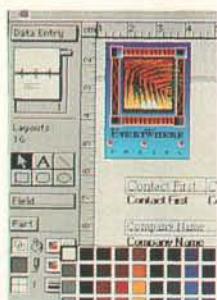
### FEATURE

## Fast Transit

PAGE 122

### NEWS

- 26 MICROBYTES**  
The first version of the P5 will run about twice as fast as a 66-MHz 486 DX2.
- 47 REPORT FROM TOKYO**  
**In the Land of the Double Byte**  
*by T.R. Reid*  
Japan's software developers work wonders.
- 52 FIRST IMPRESSIONS**  
**Apple's Performas: Macs for the Home**  
*by Tom Thompson and Tom R. Halfhill*  
Apple tackles the home market.
- 58 ProTracer**, this printer/plotter incorporates exquisite detail



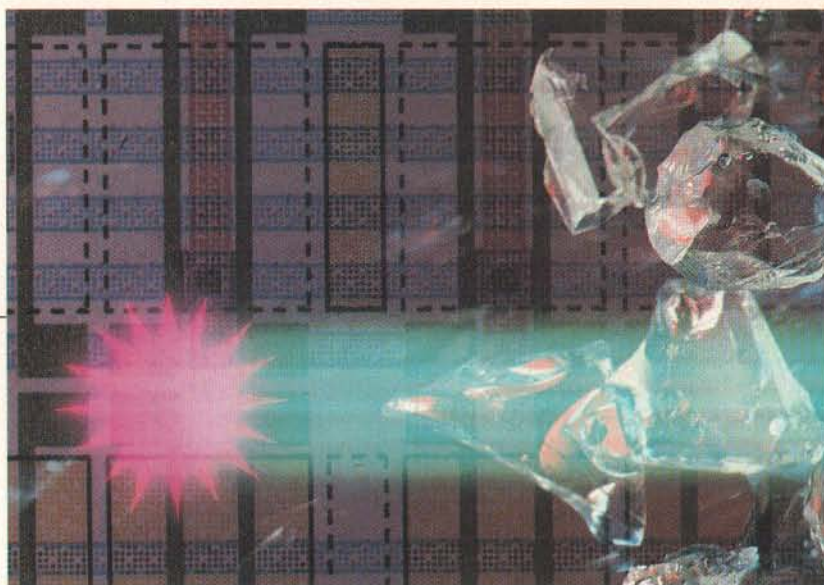
**FileMaker Pro 2.0**, Claris offers Mac and Windows users a dynamite database

**Amstrad Notepad NC100**, surely the last Z80-based computer

**ScanMan Color**, color your view of hand scanners

**Dashboard for Windows**, a new way to drive Windows

- 68 WHAT'S NEW**  
Trakker backs up from the enhanced parallel port; PC/Television puts TV on your PC; and more.



### FEATURES

- 122 Fast Transit**  
*by Trevor Marshall*  
New buses dramatically increase speed and will be showing up in systems soon.
- 137 Silicon Brains**  
*by T. J. Sejnowski and P. S. Churchland*  
Innovative computer devices are coming from studies of the human brain.
- 149 Plugging Into the Internet**  
*by Daniel P. Dern*  
If you've ever wondered how you can access the Internet, here's how.  
**Locating Internet Access in Europe**  
*by Merik Voswinkel*

### STATE OF THE ART

#### OPERATING-SYSTEM TRENDS

- 158 Overview: Operating-System Trends**  
*by John Donovan*  
Desktop operating systems deliver mainframe/minicomputer features.
- 167 Windows NT Up Close**  
*by Jon Udell*  
Microsoft's next-generation operating system could live up to its hype.
- 179 OS/2 at the Crossroads**  
*by Mark Minasi*  
Overcoming market resistance.
- 182 The Future of System 7.0**  
*by Tom Thompson*  
Apple's plans for a smooth transition to RISC.
- 186 GUIs, Applications, and Unix**  
*by Mary Hubley*  
Vendor unity and Unix.
- 190 NextStep: The Sleeper**  
*by Tom Yager*  
NextStep quietly fills the need.
- 192 Univel's Trim Unix**  
*by Matt Trask*  
A thinner, more attractive Unix.
- 195 Resource Guide**





- 198 SOLUTIONS FOCUS**  
**The New Wave of Removable Storage**  
*by Raymond GA Côté and Stanley Wszola*  
 From MOs to docking bays, the BYTE Lab selects the best removable-storage solutions.



- 212 Fast 486 File Servers**  
*by Stephen Platt, Tadesse Giorgis, Leslie Reisz, and Steve Apiki*  
 Tests of 12 486 file servers.

- 223 CorelDraw 3.0: A Swiss Army Knife for Illustrators**  
*by G. Armour Van Horn*  
 More than just an illustration package.

- 227 Compaq's Newest Notebooks**  
*by Howard Eglowstein*  
 The colorful LTE Lite/25c and inexpensive Contura make welcome additions to Compaq's notebook line.

- 233 Color Ink-Jet Printers Take Whacks at Wax**  
*by Howard Eglowstein*  
 Hewlett-Packard and Canon release colorful new products.

- 235 DGX Takes the Direct Approach to Graphics Performance**  
*by Jake Richter*  
 Dell's direct graphics accelerator speeds Windows and CAD.

- 241 Racing at 33 MHz: Quadra 950 and Radius Rocket 33**  
*by Tom Thompson*  
 Apple's most powerful Macintosh and Radius's latest accelerator board provide ample computing power.

- 247 FrameMaker: Power Publishing for Windows**  
*by Tom Yager*  
 FrameMaker brings its workstation-bred document publishing power to Windows.

- 251 Cyrix Cx486SLCs Hit the Desktop**  
*by Roger C. Alford*  
 The Tandon Option 386SLC/50 and Zeos 486SLC-25 are the first desktops to incorporate Cyrix's new processor.

- 254 Reviewer's Notebook**  
*by the BYTE Lab*  
 The BYTE Lab finds a solution for testing removable storage devices: CorelSCSI and an Adaptec controller.

## HANDS ON

- 259 UNDER THE HOOD Disk Arrays Explained**  
*by Roger C. Alford*  
 Inside RAID drive array specifications 0 through 5 and beyond.

- 267 SOME ASSEMBLY REQUIRED Mac OOP Explained**  
*by James H. Parshall*  
 Build a tool palette as you learn object-oriented programming techniques.

- 275 SOFTWARE CORNER Creating Bit-Mapped Buttons**  
*by James Stading, Tom Thompson, and Ben Smith*  
 A Windows file manager, Telnet for Macs, and dired sans emacs.

- 277 BEYOND DOS OS/2 2.0 Programming Tools Arrive—Finally**  
*by Steve Mastrianni*  
 OS/2 programmers now have a wide choice of development tools.

- 282 ASK BYTE**  
 Internet access; modem failures; file-compression utilities; and more.

- 101 USER'S COLUMN On the Road Again**  
*by Jerry Pournelle*  
 Laptops, Flashdrives, and power supplies at Chaos Manor.

- 256 BOOK AND CD-ROM REVIEWS Is Artificial Life Possible?**  
*by Hugh Kenner, Tom Yager, Raymond GA Côté, and Stanford Diehl*  
 Steven Levy's *Artificial Life*, Visual Basic for beginners and pros, and Corporate Snapshots on CD-ROM.

- 348 STOP BIT Trivial Pursuits**  
*by Daniel Seligman*  
 Computing diversions offer their own rewards.

- 10 EDITORIAL Open Markets, Better Computers**  
*by Dennis Allen*

- 20 LETTERS**  
 Infoglut kudos; responses to William F. Buckley Jr.; Usenet news groups; WEB's compression; and other topics.

## READER SERVICE

- 344** Editorial Index by Company  
**340** Alphabetical Index to Advertisers  
**342** Index to Advertisers by Product Category  
 Inquiry Reply Cards: 342A

## BUYER'S GUIDE

- 285** Mail Order  
 Hardware/Software Showcase  
 Buyer's Mart

## PROGRAM LISTINGS

From BIX: Join "listings/frombyte92"

## INSIDE BYTE

BYTE (ISSN 0360-5280) is published monthly with additional issues in October and November by McGraw-Hill, Inc. U.S. subscriber rate \$29.95 per year. In Canada and Mexico, \$34.95 per year. European surface mail subscriptions \$50, airmail \$70. Non-European subscriptions, \$50 surface mail or \$75 airmail. All foreign subscriptions are payable in U.S. funds that can be drawn on a U.S. bank. Single copies \$3.50 in the U.S., \$4.50 in Canada. Executive, Editorial, Circulation, and Advertising Offices: One Phoenix Mill Lane, Peterborough, NH 03458. Second-class postage paid at Peterborough, NH, and additional mailing offices. Postage paid at Winnipeg, Manitoba. Registration number 9321. Registered for GST as McGraw-Hill, Inc., GST #123075673. Printed in the United States of America. **Postmaster:** Send address changes and fulfillment questions to BYTE Subscriptions, P. O. Box 552, Hightstown, NJ 08520.

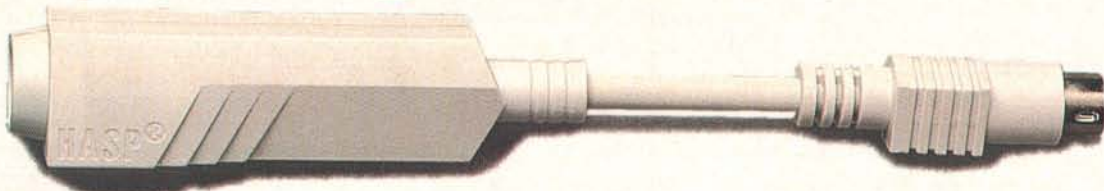


## BYTE Topic Index

*This index helps you find articles that contain information on each of the listed topics. (The topic list changes each month.) Combined with the table of contents (page 4) and the Editorial Index by Company (page 344), you can identify articles by type, subject, title, author, or product discussed.*

AMIGA 149	DRIVES 68, 101, 198, 254, 259	MULTIMEDIA 68	SCANNERS 58, 68
ARTIFICIAL LIFE 256	ETHERNET 68	NETWORKING 20, 68, 137, 179, 212, 259	SCIENCE AND ENGINEERING 68
BUS 122	FAX 68	NEXT 26, 158, 198	SECURITY 68
BUSINESS 68	FILE SERVERS 212	NEURAL NETWORKS 137	SOLAR PANEL 68
CAD 20, 58	FREEWARE/SHAREWARE 275	NEUROSCIENCE 137	SOUND 68
CD-ROMS 26, 68, 256	GAME THEORY 348	NOTEBOOKS 52, 58, 227	STORAGE 101, 198, 259
CHIPS 26	GRAPHICS 223, 235	OPERATING SYSTEMS 158, 167, 179, 195	SYSTEM 7.0 158, 179
COLOR 233	INTERNET 20, 149, 282	OS/2 101, 158, 167, 195, 254, 277	TELECOMMUNICATIONS 282
COMPRESSION 20, 282	KANJI 47	P5 26	TOUCHSCREENS 68
COPYRIGHT LAW 26	KEYBOARDS 68	PALMTOPS 101	UNIX 26, 68, 149, 158, 167, 179, 195, 212, 247, 275
CPU 122, 251	LAPTOPS/NOTEBOOKS 47, 52, 58, 101, 227	PLOTTERS 58	UPGRADABLE 251
DATABASES 58	LOCAL BUS 122, 235, 254	PRINTERS 58, 68, 233	UPS 68
DESKTOP PUBLISHING 247	MACINTOSH 26, 52, 58, 68, 101, 149, 158, 198, 241, 254, 259, 267, 275	PROGRAMMING 68, 256, 267, 275, 277, 348	UTILITIES 282
DISKS 259	MATHEMATICS 20	RAID 259	WINDOWS 58, 68, 101, 149, 158, 167, 195, 198, 223, 233, 247, 251, 254, 275, 277
DOS 68, 149, 167, 198, 251, 254, 277	MONITORS 282	RISC 167	WORD PROCESSING 47
DRAWING/ILLUSTRATION 223			

## MacHASP<sup>®</sup> The Professional Software Protection for the Macintosh



SEE US AT  
**COMDEX/Fall '92**  
Booth #S 886



MacHASP is the most advanced hardware based software protection system for Macintosh computers.

Each MacHASP key contains a unique code, recognized by the protected software. During runtime, the protected program checks whether a MacHASP key with the appropriate code is connected to the computer. If the key's code is confirmed, the software can be executed. If not, the software will not run. The HASP system is based on advanced ASIC (Application Specific Integrated Circuit) components and sophisticated encryption algorithms. State-of-the-art engineering ensures full protection of your software with no hassles for your clients.

### THESE ARE SOME OF MacHASP'S OUTSTANDING FEATURES:

- MacHASP keys are totally transparent to the operation of the computer and any peripheral equipment.
- The user can create backup copies freely and can run your software directly from a hard-disk or a backup diskette (the original diskette is not required).
- The protection system is easy to incorporate in your software. All necessary software, examples and documentation are provided.
- MacHASP keys contain a memory which can be read and written on any computer.



**IT IS POSSIBLE TO PROTECT PROGRAMS WITHOUT THE SOURCE CODE**

For further information, please see our full-page ad in this issue for the nearest HASP distributor.



**ALADDIN**  
KNOWLEDGE  
SYSTEMS LTD.

15 Beit Oved St., Tel-Aviv, Israel  
P.O.Box: 11141 Tel-Aviv 61110,  
Tel: 972-3-5375795  
Fax: 972-3-5375796





## The new TI TravelMate™ 4000 family. Your windows to the future.



MICROSOFT  
WINDOWS  
READY TO RUN

Now you can step up to 486 power with integrated Windows™ 3.1 and DOS® 5.0. Introducing the TI TravelMate 4000 notebook computers — ready for today's applications and those of tomorrow.

Choose from three models to meet your needs. They all feature an enhanced 10" diagonal VGA display, plenty of memory and storage, and four to five hours of typical battery life. Plus the new TM4000 notebooks mea-

TM4000 WinSX™/16	
486SX 16MHz*	Pre-installed
4MB-8MB RAM	Windows 3.1 and DOS 5.0
80MB HDD	TravelPoint™ pointing device
TM4000 WinSX/25	
486SX 25MHz*	Pre-installed
4MB-20MB RAM	Windows 3.1 and DOS 5.0
120MB HDD	TravelPoint pointing device
TM4000 WinDX™/25	
486DX 25MHz*	Pre-installed
4MB-20MB RAM	Windows 3.1 and DOS 5.0
120MB HDD	TravelPoint pointing device

\*Twice the performance of a 25MHz 386SL processor.

sure only 8.5 x 11 x 1.8" and weigh in at under 5.6 lbs. (including battery). All this at a surprisingly affordable price and with ample performance to take you well into the future.

For more information and the name of a dealer near you, call 1-800-527-3500



**TEXAS  
INSTRUMENTS**

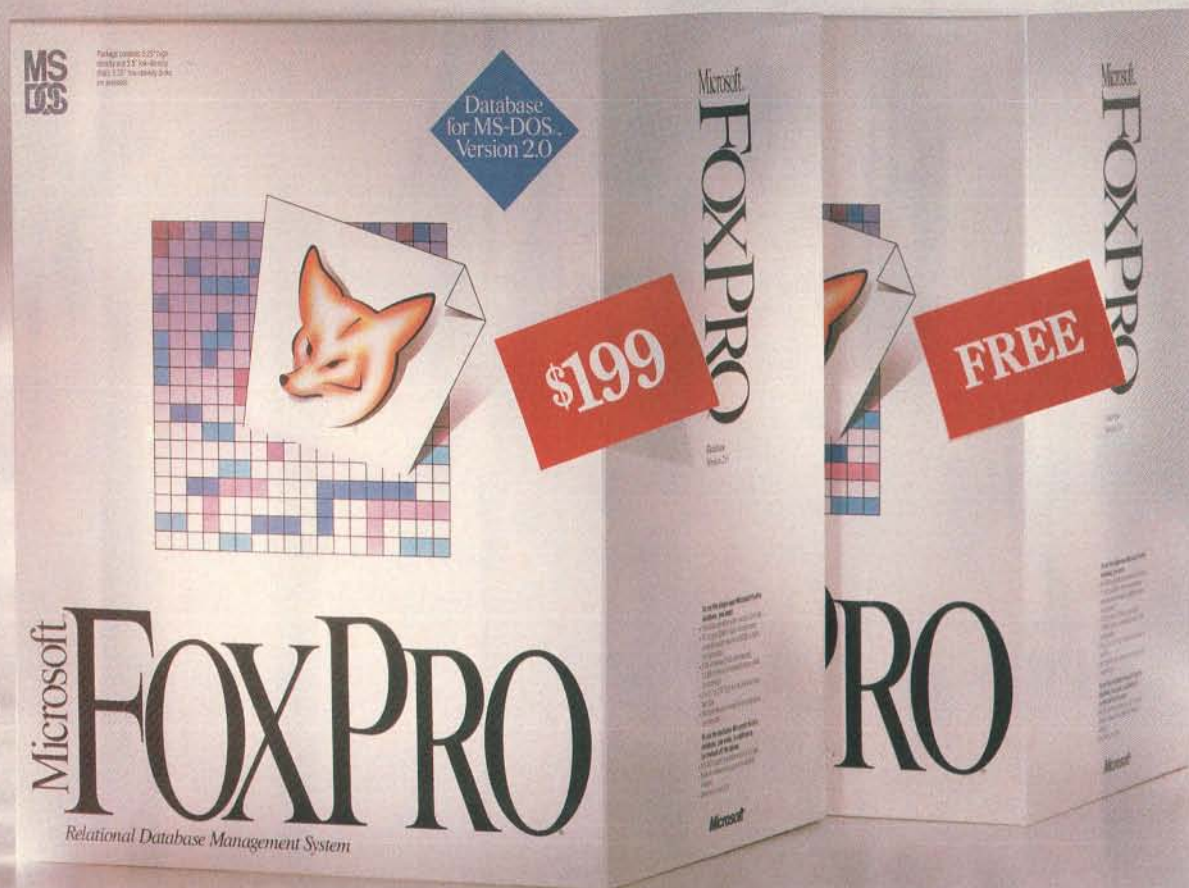
TravelMate, TravelPoint, WinSX and WinDX are trademarks of Texas Instruments Incorporated. DOS is a registered trademark, and Windows and the Microsoft Windows Ready To Run logo are trademarks of Microsoft Corporation.

©1992 TI 76564

Circle 181 on Inquiry Card.



# The world's fastest PC database comes with a commitment that will last forever.



## And an offer that won't.

© 1992 Microsoft Corporation. All rights reserved. Printed in the USA. \*Plus \$10.00 freight and applicable sales tax. Reseller prices may vary. \*\*Free; you don't even pay freight. †dBASE IV Benchmarks performed by Micro Endeavors, Inc. DB2 Benchmarks performed by Patrick O'Neil, "The Set Query Benchmark," in "The Benchmark Handbook for Database and Transaction Processing Systems," Morgan Kaufman Publisher, 1991. You must currently be a licensed user of a database product to qualify for this special upgrade offer. To qualify for this offer at your reseller you must bring proof of purchase with you: 1) the original disk from your program, 2) title page of the manual, or 3) a copy of the sales receipt. You must register your copy of Microsoft FoxPro 2.0 to qualify for a free upgrade to version 2.5. (If you get your upgrade directly from Microsoft, you will be automatically registered.) You will then be notified when your free upgrade is available.



**Trade up to FoxPro 2.0 from other database products for only \$199 and get a free 2.5 upgrade.**

If you use dBASE\*, Paradox\*, Clipper™ or any other PC database, here's an offer you'll want to nab before it's gone forever: Microsoft® FoxPro® database version 2.0 for just \$199\*, and a free\*\* upgrade to version 2.5 for MS-DOS\* or for Windows™ operating systems as soon as it's released.

It's our way of celebrating the Microsoft and Fox merger. And of introducing you to the fastest, most powerful X-BASE solution available. This is a solution that's sure to stay at the head of the database pack, with Microsoft's full commitment.

**The fastest PC database.**

FoxPro 2.0 gets unequalled results, thanks to superior technology. Our Rushmore™ Query Optimization lets you get the fastest speed of any PC-based database — up to 4 times faster than DB2\* and 10 times faster than dBASE IV.\*†

**The most productive environment.**

It's intuitive and graphical to make your life easier. With Relational Query-By-Example (RQBE) you can simplify complex tasks. And with our exclusive Graphical Browse, you can choose the way you view your data.

With the Screen Builder you can quickly design data-entry forms by simply dragging objects into place. And for really quick turnaround, try the Application Generator. It creates complete, fast applications for you — applications you can then customize to fit your needs.

Then there are the other powerful tools like Trace and Debug windows, Project Manager, Menu Builder, Report Writer and Label Writer. With all these tools, you'll write the most powerful, robust apps imaginable.

Is it any wonder that FoxPro 2.0 received the *Byte* Award of Excellence, *InfoWorld* Product of the Year, *PC Magazine's* Technical Excellence Award and *PC Magazine's* Editors' Choice Award, as well as the *Data Based Advisor* and *DBMS* Readers Choice awards?

**Your investment is secure.**

It's so easy to learn and use, you won't have to worry about losing any time getting up to speed.

You won't lose any of the work you've done, either. Microsoft FoxPro 2.0 is compatible with dBASE III PLUS\* and extends dBASE IV. This means you can move your apps over right away. In fact, you'll find they work even faster in FoxPro.

If you're thinking about what'll happen to your applications tomorrow, relax. The applications you build today under Microsoft FoxPro 2.0 will run on Microsoft FoxPro version 2.5 for Windows, MS-DOS, Macintosh\* and UNIX\*.

**Special offer for users of FoxPro.**

We have especially good news if you're a registered FoxBASE+ for MS-DOS or FoxPro 1.x user. You can upgrade to version 2.0 for only \$175 with a free upgrade to version 2.5 when it is available.

**The Microsoft commitment.**

With Microsoft's resources and Fox's expertise, we're even better positioned to develop the best products and support in the industry. We've been meeting with Fox User Groups around the country. We're planning to hold the largest Fox Developers Conference ever in Phoenix this year. And we're keeping the dialog going on the popular CompuServe® forum, FOXFORUM.

Finally, we support the initiative to create an ANSI standard for the X-BASE language. We stand behind Microsoft FoxPro 2.0 with a full 90-day money-back guarantee and great product support.

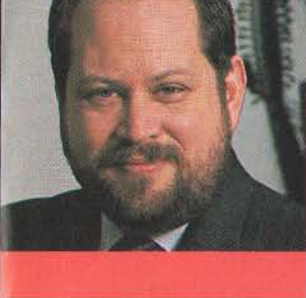
But although our commitment is long-lived, this special offer is not. So get a move on and move up to Microsoft FoxPro 2.0, fast. Because when this offer is gone, it's gone forever.

**Rush to your dealer. For the name of a dealer nearest you or to order by phone call now, toll-free:**

**(800) 228-7007, Ext. AM1**

**Microsoft®**  
Making it easier





DENNIS  
ALLEN

## EDITORIAL

# OPEN MARKETS, BETTER COMPUTERS

**W**ho Americans elect as president this November will affect everyone involved with computers throughout the world. The choice will be one that either nurtures the computer market's growth or aborts it, and market growth—not technology alone—is what spawns new and better computer products.

### **The upcoming presidential election will help decide the future of the computer industry**

Now, more than ever before, we should be concerned with the future of computing. The computer industry is showing signs of sluggishness, and the current price war has virtually every computer manufacturer retooling for low-cost, low-profit computer systems. The good news is that we'll all benefit from the reduced prices in the short run. The bad news is that this price benefit is eroding R&D budgets as computer makers continue to cut costs to stay price-competitive.

The trouble is that without heavy R&D, technology breakthroughs may be few and far between, and without those breakthroughs, we may never realize the potential of multimedia, parallel processing, and 64-bit computing—to name but a few of the known technology areas. There are also yet-to-be-discovered technology areas whose potential may be lost before it is even known. All that lost potential translates into lost productivity gains for the businesses of the world.

The hope for the computer industry is that there will be market-growth opportunities to spur new investments in R&D. Those opportunities exist in Eastern Europe, South and Central America, China, and other largely untapped markets. Every manufacturer—large or small—recognizes the market opportunities in those countries. Sure, some of those markets are just emerging, but over the next few years, the ability of the computer industry to develop those markets will shape the future of computing.

In this fast-changing world, the challenge is to define how the world trades. Meaningful free-trade agreements are the pathways to developing computer markets, and greater computer markets are the highways to developing computer technology.

If you need proof, consider Brazil. Its government sought to protect its domestic computer industry, and the result was lackluster computers with high prices and a thriving black market for imported systems. Thankfully, all that is changing as Brazil moves toward lifting some of its trade restrictions. Meanwhile, computer mak-

ers are clamoring to get into that market.

Some skeptics would say that bigger markets do not really matter. That's just not true, though. Market potential does matter, because the greater the market opportunities, the greater the reward for innovating. Every businessperson knows that.

Other naysayers call computers "commodities" that can compete only on price. Not so. If you've looked at 486-based systems lately, you know what I mean. If computers are just commodity products, why do you have to worry about which local bus standard a system uses, whether its graphics are VGA- or 8514/A-compatible, whether it has a drive array, and if it does, what level RAID is it? Moreover, if these machines are supposed to be commodity products, why do they all work differently on your network?

There is more on which computers can compete than just price, and there are many problems for which new technology solutions can be developed. It's just a matter of justifying the cost with an adequate market.

Creating new worldwide markets is part of what the U.S. presidential election is all about. There could hardly be greater polarization between the two candidates on the matter of free trade. President Bush has placed free trade and world markets high on his agenda, while Governor Clinton is more concerned with protectionism.

If the world moves toward President Bush's vision of world markets, the computer industry will be ignited by new opportunities, and investment in R&D will prove profitable. As users, we will surely benefit by the richness of innovation from an ignited computer industry.

The alternative is to see the computer industry and our potential options take a nosedive during the next five years. Any industry that ever made cuts in R&D fell into decline within five years. And just as surely as the computer industry's R&D budgets are cut, so will be the future of computing.

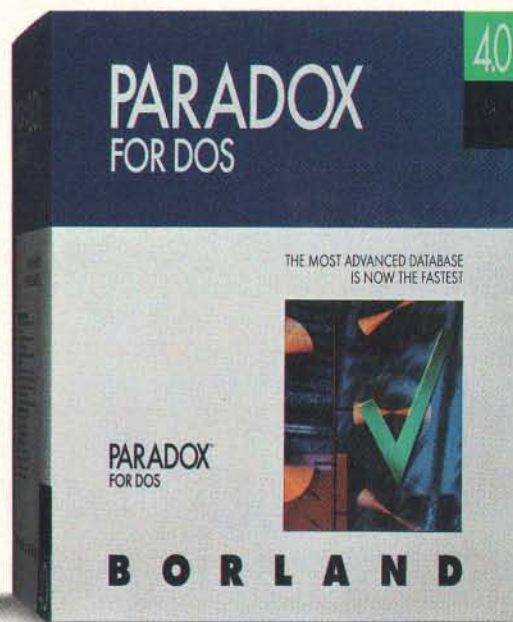
—Dennis Allen  
Editor in Chief



# DEMAND PERFORMANCE

## *Introducing Paradox 4.0 for DOS*

*The most  
advanced database  
is now the fastest*



Circle 76 on Inquiry Card (RESELLERS: 77).



# DEMAND



## Paradox is fastest

NSTL results prove new Paradox® 4.0 is the world's fastest relational database! Thanks to Borland's new WarpSpeed™ performance, Paradox 4.0 sets the standard in performance for both network and standalone use. For you, this means faster answers to queries, faster memory access and faster multiuser applications.

In fact, Paradox 4.0 gives you unparalleled performance throughout all aspects of database management and application development. As NSTL put it, "Paradox is clearly the best all-around product evaluated." It beats FoxPro hands down.



Software Digest's NSTL report rates Paradox highest of all databases tested in Overall Power and Performance.

## New Windows-like interface

Our new Windows-like interface makes using Paradox 4.0 more intuitive than any other database. Context-sensitive SpeedBar™ controls give you instant access to your frequently used commands and features. Movable, resizable windows, pull-down menus and mouse support make creating and editing your database simple. And new dialog boxes give you the choices you need in one place, saving time and effort.

## The fastest way to get an answer

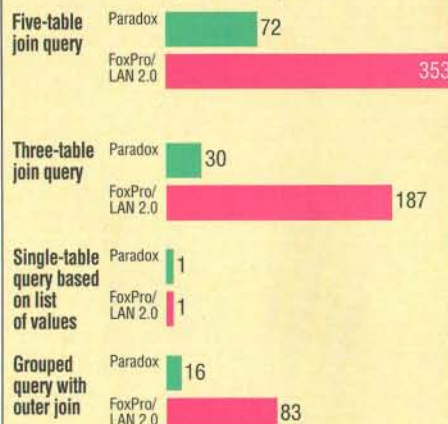
Paradox pioneered Query By Example (QBE), the easiest way to get answers from your database. Now, a built-in query optimizer enhances QBE, automatically finding the fastest path to the answers you're seeking. Plus, multi-table forms and reports make everything from data entry to presentations a snap—all with-out programming.

## WarpSpeed

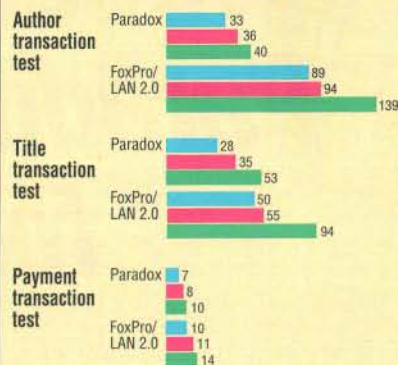
WarpSpeed stands for Wildly Accelerated Relational Performance. It reflects Borland's commitment to performance, and is also an integral part of our dBASE® and InterBase™ development programs.

## NSTL tests confirm Paradox 4.0: Quicker than a Fox

### Single-user performance tests (in seconds)



### Multiuser performance tests (in seconds)



#### Multiuser Legend:

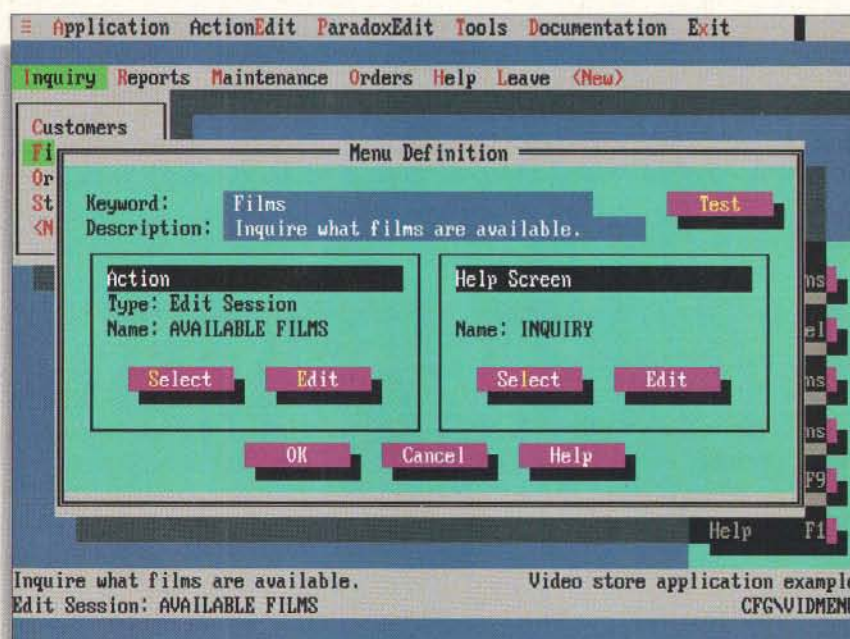
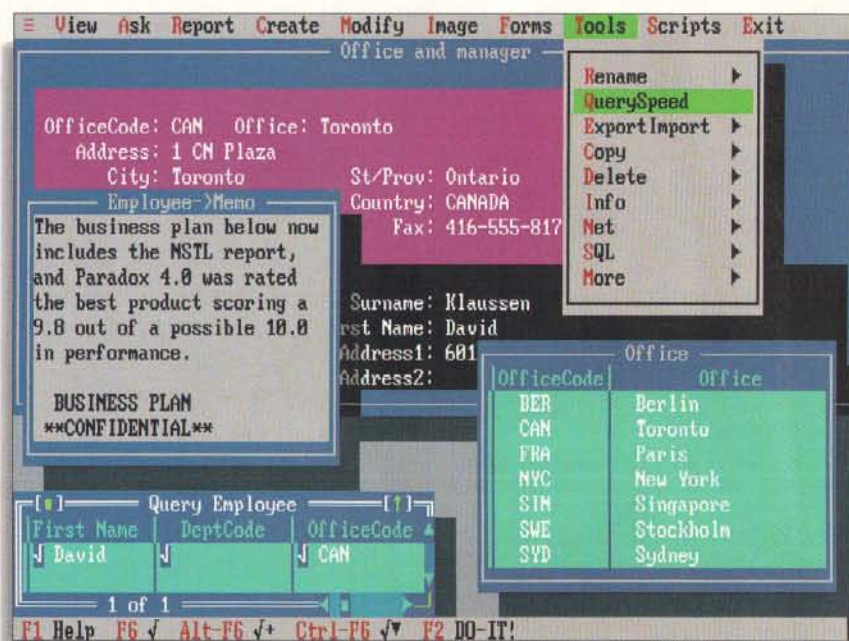
1 station ■ 3 stations ■ 8 stations ■  
To test the speed of transaction performance, NSTL designed a database for book order entry. Each record contained an author, a title, an ISBN number, a price and inventory information. The database contained 25,000 books and 5,000 authors.



# PARADOX

## New memo fields

Paradox 4.0 gives you the power to manipulate data you couldn't manage with ordinary databases. With new variable length memo fields, you have the ability to effortlessly manage large amounts of text information throughout your applications. And you can store anything you want in the new binary field—word processor documents, sound, bitmapped graphics, multimedia data—and then manipulate it under program control. Each can hold up to 256Mb of data per field—up to 4 gigabytes per table! There's no easier way to manage large applications.



◀ With the new Applications Workshop, you can build complete applications that include pull-down menus, mouse support, transparent multiuser edit sessions and more. Best of all, it's simple!

## Efficient memory management

Paradox 4.0 gives you the best way to manage memory. VROOMM™ with Turbo Drive™ provides more available memory and more efficient memory utilization. So Paradox 4.0 runs on any 286 PC or above. In addition, Paradox 4.0 can run as a DOS application under the Microsoft® Windows operating environment, thanks to complete DPMI support.



# DEMAND

## The most award-winning database

Since its introduction, Paradox has won more awards for technical excellence and customer satisfaction than *any* other database. Awards from every major computer magazine and periodical from around the world. In addition, in the J.D. Power and Associates® survey,\* Borland ranked as the #1 (tied) Application Software Publisher in Customer Satisfaction Among Business Users. All of which has made Paradox the favorite of users and developers alike.



May 28, 1991  
Paradox, Version 3.5



March 1992  
Paradox 3.5



PARADOX® SQL LINK



Rated # 1  
Vol. 8, Number 2  
February 1991



May 1991  
Paradox 3.5



PARADOX® 4.0



Rated # 1  
Vol. 9, Number 2  
May 1992

## Faster network performance

Paradox 4.0 is the fastest multiuser network PC database ever. And it's network-ready right out of the box. Multiple users can read, write and modify data simultaneously. You get all this, plus new automatic group lock security that allows multiple users to share data flexibly, providing dramatically increased performance. Just another reason Paradox 4.0 is the best investment for your business.

## Transparent access to SQL data

With Paradox SQL Link (sold separately), you can seamlessly access remote SQL data. You can then work with this data using standard Paradox features such as Query By Example. Paradox does all the translation for you.

Paradox SQL Link completely shields you from the intricacies of PC and database server communications. When you specify an SQL table operation, Paradox SQL Link automatically selects the correct communications protocol, opens up

## Paradox Developer's Corner

### Powerful, procedural language

The Paradox Application Language (PAL™) lets you create sophisticated Paradox applications quickly. PAL procedures allow for private and global variables, array passing and variable scoping. Paradox 4.0 includes more than 90 new commands and functions.

### Powerful UI controls

Easily construct your applications with a robust look and feel using the built-in UI controls: non-modal pull-down menus, dialog boxes (with push buttons, check boxes, radio buttons, pick lists, type-in lines and more), pop-up menus, mouse support and multiple overlapping windows.

### Event-driven extensions

GetEvent() passes keyboard, mouse and/or system events into your procedures for dispatching. Use dynamic arrays to pass dynamically created data structures to procedures. This greatly increases the modularity and reusability of your code.

### Leverage Paradox behavior

Build on Paradox's multiuser support for automatic locking, multi-table forms and referential integrity. Define special error-handling procedures to trap and process error conditions, giving you complete flexibility over users' interaction with your custom application.



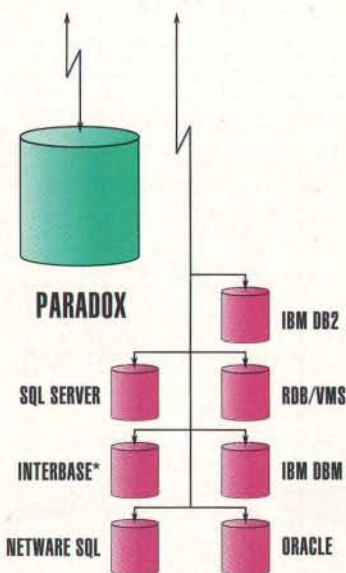
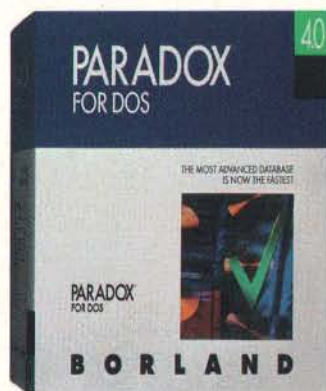
J.D. POWER  
AND ASSOCIATES®

### 1. Borland

1. WordPerfect
3. Lotus
4. Microsoft
5. Claris
6. Aldus



# BORLAND



*Paradox SQL Link supports more industry-standard database servers than any other PC database available. (\*And the InterBase SQL connection will be available soon.)*

a communication link, relays statements to the database server and presents the results of your query.

By using Paradox SQL Link, you can now enjoy the benefits of SQL databases without the difficulty of mastering the SQL programming language. In addition, Paradox SQL Link operations follow database server security restrictions.

## **Borland—the database leader**

Borland is the acknowledged leader in PC relational databases. More users and developers trust their data to Borland products than any other company. And an integral part of that trust is Paradox.

Paradox 4.0's power to create and manage sophisticated applications, maintain data integrity, handle large quantities of data, perform complex database operations and connect to corporate data is critical to the success of a database management system today. No other PC database meets this challenge like Paradox 4.0—the most advanced database. Best of all, with Paradox 4.0's 60-day, money-back

guarantee, you can order risk-free today. So demand the best. Demand Paradox!



**To upgrade or  
order, see your  
dealer or call  
1-800-331-0877,  
ext. 5874 today!**

**Canadian customers call  
1-800-461-3327.**

# B O R L A N D

*Software Craftsmanship*

Circle 76 on Inquiry Card (RESELLERS: 77).



## EDITOR IN CHIEF

Dennis Allen

## EXECUTIVE EDITORS

**New York:** Rich Malloy  
**Peterborough:** Rich Friedman

## MANAGING EDITOR

Anne Fischer Lent

## ASSISTANT MANAGING EDITOR

Lauren A. Stickler

## NEWS

**Peterborough:**  
*Senior Editor:* Dan Muse  
*News Editors, What's New:* Martha Hicks, Carol Swartz  
*Microbytes:* David L. Andrews  
*News Assistant:* June Sheldon  
**San Francisco/West Coast:**  
*Bureau Chief:* Andrew Reinhardt  
*Senior Editor:* Tom Halfhill  
*News Editor:* Patrick Waurzyniak  
*Editorial Assistant:* Barbara J. Caravella  
**Los Angeles:**  
*Senior Editor:* Gene Smarte  
**New York:**  
*News Editor:* Ed Perratore  
**UK/Europe:**  
*Bureau Chief:* Andrew Redfern

## BYTE LAB

*Senior Editor & Director:* Alan Joch  
*Technical Director:* Rick Grehan  
*Technical Editors:*  
Stephen Apiki: systems, networking  
D. Barker: applications software  
Stanford Diehl: graphics software, add-ins, peripherals  
Tom Yager: multimedia, Unix, operating systems, software development  
*Testing Editors/Engineers:* Raymond GA Côté, Howard Eglowstein, Ben Smith, Stanley Wszola  
*Lab Assistant:* Selinda Chiquoine

## STATE OF THE ART/FEATURES

*Senior Editor:* Michael Nadeau  
*Technical Editors:* Janet J. Barron, Robert M. Ryan

## SENIOR TECHNICAL EDITORS

*At Large:* Tom Thompson, Jon Udell  
*Columns:* Rob Mitchell

## ASSOCIATE TECHNICAL EDITORS

Ellen Bingham, Susan Colwell, Jeff Edmonds, Tom Kevan, Cathy Kingery, Margaret A. Richard, Warren Williamson

## SENIOR CONTRIBUTING EDITOR

Jerry Pournelle

## CONTRIBUTING EDITORS

Hugh Kenner, Barry Nance

## CONSULTING EDITORS

Roger C. Alford, Jonathan Amsterdam, Nicholas Baran, Don Crabb, David Fiedler, Laurence H. Loeb, Trevor Marshall, Dick Pountain, Wayne Rash Jr., Kenneth M. Sheldon, Jane Morrill Tazelaar, Ellen Ullman, Peter Wayne

## EDITORIAL ASSISTANTS

*Office Manager:* Peggy Dunham  
*Assistants:* Linda C. Ryan, Janet A. Young

## DESIGN

*Director:* Nancy Rice  
*Associate Director:* Joseph A. Gallagher  
*Designer:* Jan Muller, Rebecca Magill

## PRODUCTION AND FINANCE

*Director:* Claudia Flowers

## PRODUCTION

*Director:* David M. Cohen  
*Production Director:* David R. Anderson  
*Senior Editorial Production Coordinator:* Virginia Reardon  
*Editorial Production Coordinator:* Barbara Busenbark  
*Systems Manager:* Sherry Fiske  
*Applications Manager:* Donna Sweeney  
*Typesetter:* Christa Patterson  
*Creative Services Manager:* Susan Kingsbury  
*Production Artist:* Lillian J. Wise  
*Advertising Services Manager:* Linda Fluhr  
*Senior Advertising Services Representative:* Lyda Clark  
*Advertising Services Representatives:* Dale J. Christensen, Karen Cilley, Rod Holden  
*Advertising Services Assistant:* Roxanne Hollenbeck  
*Quality Control Manager:* Wai-Chiu Li  
*Operations Assistant:* Lisa Jo Steiner

## FINANCE

*Business Manager:* Kenneth A. King  
*Financial Analyst:* Kathleen Deguise  
*Assistants:* Marilyn Parker, Diane Henry, JoAnn Walter, Jaime Huber, Agnes Perry

## MARKETING AND PLANNING

*Director:* L. Bradley Browne  
*Administrative Assistant:* Carol Cochran  
*Marketing Communications Manager:* Pamela Petrakos  
*Public Relations Manager:* Dawn Matthews  
*Marketing Art Director:* Stephanie Warnesky  
*Associate Art Director:* Sharon Price  
*Market Research Manager:* Julie Perron  
*Copyrights Manager:* Faith Kluntz  
*Reader Service:* Cynthia Sands  
*Marketing Assistant:* Carol Sanchioni

## CIRCULATION

*Director:* Glyn Standen  
*Subscriptions Manager:* Paul Ruess  
*Assistant Manager:* Pam Wilder  
*Subscriptions Assistant:* Christine Tourgee  
*Newsstand Manager:* Vicki Weston  
*Assistant Manager:* Karen Desroches  
*Back Issues:* Louise Menegus  
*Direct Accounts Coordinator:* Ellen Dunbar

## PUBLISHER

Ronald W. Evans

*Publisher's Assistant:* Donna Nordlund

## ADVERTISING SALES

*National Sales Manager:*  
*Jennifer L. Bartel (214) 701-8496*

## NEW ENGLAND

*Michael Lamattina (617) 860-6344*

## EAST COAST

*Kim Norris (212) 512-2645*  
*Ariane Casey (212) 512-2368*

## SOUTHEAST

*Mary Ann Goulding (404) 843-4782*

## MIDWEST

*Kurt Kelley (312) 616-3328*

## SOUTHWEST, ROCKY MOUNTAIN

*Jennifer Walker (214) 701-8496*

## SOUTH PACIFIC

*Beth Dudas (714) 753-8140*  
*Alan El Faye (213) 480-5243*

## NORTH PACIFIC

*Bill McAfee (408) 879-0381*  
*Roy J. Kops (415) 954-9728*

## INSIDE ADVERTISING SALES

*Director:* Liz Coyman (603) 924-2518  
*Assistants:* Susan Monkton, Vivian Bernier

## NATIONAL ADVERTISING SALES

*Ed Ware (603) 924-2664*  
*Patricia Payne (603) 924-2654*  
*Jon Sawyer (603) 924-2665*  
*Barry Echavarria (603) 924-2574*  
*Joseph Mabe (603) 924-2662*

## THE BUYER'S MART (1x2)

*Margot Gnade (603) 924-2656*

## HARDWARE/SOFTWARE SHOWCASE

*Ellen Perham (603) 924-2598*  
*Mark Stone (603) 924-2695*

## REGIONAL ADVERTISING SECTIONS

*Brian Higgins (603) 924-2651*  
*Barry Echavarria (603) 924-2574*  
*Larry Levine (603) 924-2637*

## BYTE DECK

*Brad Dixon (603) 924-2596*

## EURO-DECK

*James Bail (603) 924-2533*

## INTERNATIONAL ADVERTISING SALES STAFF

See listing on page 341.

## PERSONNEL

*Human Resources Administrator:*  
Patricia Burke  
*Assistant:* Fran Wozniak  
*Receptionist:* Beverly Goss

## HOW TO CONTACT THE EDITORS

We welcome your questions, comments, complaints, kudos, and submissions.

**MAIN OFFICE:** One Phoenix Mill Lane, Peterborough, NH 03458, (603) 924-9281.

**San Francisco:** 425 Battery St., San Francisco, CA 94111, (415) 954-9718.

**Los Angeles:** 15635 Alton Pkwy., Suite 290, Irvine, CA 92718, (714) 753-8140.

**New York:** 1221 Avenue of the Americas, New York, NY 10020, (212) 512-3175.

**UK/EUROPE:** Wimbledon Bridge House, One Hartfield Rd., Wimbledon, London SW19 3RU, England, 011-44-81-543-1234.

**ELECTRONIC MAIL:** On BIX, send to "editors." All BYTE editors and columnists also have individual mailboxes on BIX for easy access.

**MCI:** 250-0135 BYTE Magazine. Many editors also have individual MCI addresses in their own name.

**OTHERS:** Many editors also are reachable through uunet, AppleLink, CompuServe, and numerous other services.

U.S. fax: Editorial: (603) 924-2550

Advertising: (603) 924-7507

U.K. fax: 011-44-81-540-3833

## SUBMISSIONS

**Authors:** We welcome article proposals and submissions. Unacceptable manuscripts will be returned if accompanied by sufficient return postage. Not responsible for lost manuscripts or photos.

**Vendors:** We welcome news of your new products; please call the News department or the BYTE Lab at the earliest possible date. We cannot be responsible for unsolicited product samples.

## SUBSCRIPTION CUSTOMER SERVICE

**Inside U.S. (\$600) 232-BYTE;** outside U.S. (609) 426-7676. For a new subscription—(800) 257-9402 U.S. only, or write to: BYTE Subscription Dept., P.O. Box 555, Hightstown, NJ 08520. Subscriptions are \$29.95 for one year, \$54.95 for two years, and \$74.95 for three years in the U.S. and its possessions. In Canada and Mexico, \$34.95 for one year, \$64.95 for two years, \$87.95 for three years. In Europe, £29 (U.S. \$50) for fast surface delivery, £41 (U.S. \$70) for air delivery. Non-European countries U.S. \$50 for surface mail, or U.S. \$75 for air mail. Single copy price is \$3.50 in the U.S. and its possessions, \$4.50 in Canada. Foreign subscriptions and sales should be remitted in U.S. funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first issue.

## PHOTOCOPY PERMISSION:

Where necessary, permission is granted by the copyright owner for those registered with the Copyright Clearance Center (CCC), 27 Congress St., Salem, MA 01970, to photocopy any article herein for personal or internal reference use only for the flat fee of \$1.50 per copy of the article or any part thereof. Correspondence and payment should be sent directly to the CCC, 27 Congress St., Salem, MA 01970. Specify ISSN 0360-5280, \$1.50. Copying done for other than personal or internal reference use without the permission of McGraw-Hill, Inc., is prohibited. Requests for special permission or bulk orders should be addressed to the publisher. BYTE is available in microform from University Microfilms International, 300 North Zeeb Rd., Dept. PR, Ann Arbor, MI 48106 or 18 Bedford Row, Dept. PR, London, WC1R 4EJ, U.K.

Copyright © 1992 by McGraw-Hill, Inc. All rights reserved. BYTE and BYTE are registered trademarks of McGraw-Hill, Inc. Trademark registered in the United States Patent and Trademark Office.



Member  
Audit Bureau of Circulation



INTERACTIVE ON-LINE SERVICE

## DIRECTOR OF COMPUTER-RELATED SERVICES

Stephen M. Laliberte

## EXCHANGE EDITORS

*Amiga Exchange:* Joanne Dow  
*Entertainment and Leisure Exchange:* Rich Taylor  
*IBM Exchange:* Barry Nance  
*Programmers Exchange:* Bill Nicholls  
*Professionals Exchange:* David Reed  
*Tojerry Exchange:* Jerry Pournelle  
*Writers Exchange:* Wayne Rash Jr.

## SENIOR EDITOR, ON-LINE SERVICES

Anthony J. Lockwood

## MEMBER SERVICES MANAGER

Kevin Plankey

BIX, owned and operated by General Videotex Corporation, is a worldwide, low-cost, on-line information service featuring industry news, downloadable software, powerful electronic mail, previews of upcoming BYTE articles, the full text of published issues of BYTE, and source and/or executable code for BYTE benchmarks and noncommercial software mentioned in feature articles. BIX also offers unmatched "conferences" on virtually every computer-related topic imaginable, where you can share information with thousands of other computer pros. To subscribe via modem, set your communications software to full duplex, 7 bits, even parity, 1 stop bit, and then call (800) 225-4129; in MA, call (617) 861-9767. International, call NU1310690157800. Then hit the Enter/Return key and enter "BIX" when asked to log in; then enter "BIX.VILLE" when asked for a name. For current fees and more information, call (800) 695-4775 or (617) 354-4137 on voice phone; fax: (617) 491-6642.

## OFFICERS OF MCGRAW-HILL, INC.:

*Chairman, President and Chief Executive Officer:* Joseph L. Dionne, *Executive Vice President, General Counsel and Secretary:* Robert N. Landes, *Executive Vice President—Operations:* Harold W. McGraw III, *Senior Vice President, Treasury Operations:* Frank D. Penglase.

*Founder:* James H. McGraw (1860–1948).



**NEW!**

# Borland's *Visions* Video Series

## Now the easiest way to learn software!

### Borland makes learning fun

Now there's a faster, easier and more entertaining way to gain proficiency in today's top software and advanced technology. In a matter of hours, you can master all the concepts presented. You're taught exactly what you want to learn. And it's all self-paced, so you can learn when and where it's convenient for you.

### Learn from the experts

Taught by internationally recognized experts, each

videotape training course provides a thorough and fun way to learn, using easy-to-understand examples presented in clear, everyday language. Lively presentation is further enhanced by state-of-the-art production techniques and exciting animation

graphics. Easy-to-follow workbooks written by recognized authorities solidify the concepts. And, in many cases, free sample source code is included so you can get off to a fast start by simply plugging it into your application.

### Ideal for everyone who uses a PC

Programmers, developers, MIS, department managers—nearly anyone who uses a PC can benefit from the Borland *Visions* Video Series. Every videotape is a complete, step-by-step tutorial.

So whether it's understanding what Object-Oriented Programming is all about or learning how to best manage corporate data, Borland has a video for you. Most of all, it's fun. Order today!

"Borland clearly invested a lot of care in this project, and the result is an excellent example of what a multimedia course can achieve when done right."

Craig Menefee  
writing about *World of C++* in  
*Computer Shopper*, Feb. 1992

## Every video training package under \$100!

### Make the Move from C to C++!

#### The Award-winning World of C++

*World of C++* is the easy way for the experienced C programmer to step up to C++ and the power of Object-Oriented Programming. With 21 lively video lessons, David

Intersimone gives you a solid understanding of how C++ works, and how you can use it to streamline your programs and speed through development cycles. Comes complete with videotape, workbook and sample source code. Workbook written by Bruce Eckel. 120 minutes.

**only \$99<sup>95</sup>**

"The combination [of video, workbook and source code]... is the best introduction I've ever seen to any complex language."

Jerry Pournell, *BYTE*, December 1991



#### World of ObjectWindows for Turbo Pascal

The ObjectWindows™ application framework provides easy-to-add-on Windows user interfaces for Turbo Pascal®. This complete training package will show you how to get the most out of this cutting-edge

technology in the shortest amount of time. Hosted by David Intersimone. Workbook written by Tom Swan. Sample source code included. 120 minutes.

**\$99<sup>95</sup>**



**Free compiler included!**

#### Learn Programming Today with Turbo Pascal

Did you ever wish you had the power to program your own computer and write your own programs? Easy videotape instructions, workbook and sample programs will teach you how to write programs in record time. Perfect for the beginning

programmer. Hosted by Zack Urlocker. Workbook written by Keith Weiskamp. 90 minutes.

**\$69<sup>95</sup>**



#### World of ObjectVision

Learn to create your own Windows applications *without programming*. With ObjectVision® it's easy, and this clear videotape with sample applications makes it even easier. Now everyone from non-programmers just getting started... to developers looking for faster application prototyping can create

their own Windows applications in no time. Hosted by John Mandell. Sample ObjectVision applications included. 85 minutes.

**\$39<sup>95</sup>**



#### World of ObjectWindows for C++

Now C++ programmers can skip the tedious chore of writing Windows user interfaces—with just a few lines of code you can add the robust ObjectWindows application framework to your application. Two videotapes, workbook

and source code make it easy to get up to speed fast in Windows. Hosted by David Intersimone. Workbook written by Tom Swan. 120 minutes.

**\$99<sup>95</sup>**



#### World of Database Management

Now more than ever, information is power. Learn the latest concepts in database management software, including object-oriented technology and Windows database technology. If you want to manage corporate information in the most efficient and profitable way, this videotape is a must-see. Hosted by Philippe Kahn. 29 minutes.

**\$19<sup>95</sup>**



#### World of Objects

Philippe Kahn and his special guests, including Niklaus Wirth, take you on a guided tour of the basic concepts behind

Object-Oriented Programming. A fact-filled videotape overview full of fun and insight for everyone. 20 minutes.

**\$19<sup>95</sup>**

Now, with an order over \$30, you get *World of Objects* or *World of Database Management* absolutely FREE!

To order, and get your free video, see your dealer or call now,

**1-800-331-0877, ext. 6931**

**60-day, money-back guarantee**

**GET A FREE VIDEO**

**B O R L A N D**  
*Software Craftsmanship*





# Your upgrade

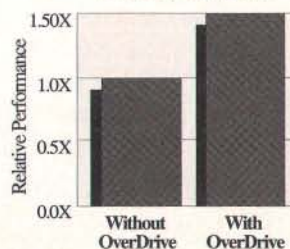
## Introducing Intel OverDrive™ Processors.

With built-in upgradability we promised you room for the future. Room for more power.

Well, the future has arrived. Presenting a revolutionary new

category of single-chip upgrades: Intel OverDrive Processors. The easiest, most cost-effective way to add even more power to your system—for Intel486™ SX PCs

i486™ SX-20 System Performance: Microsoft Word for Windows\*



now, and soon for all 486 systems and beyond.

Just pop in a new OverDrive Processor and you'll improve overall i486 SX system





# just checked in.

performance by up to 70 percent. Added performance that will benefit over 50,000 compatible software applications.

And that goes for today's demanding Windows software, too.

**WE MAKE  
COMPUTERS  
WORK  
HARDER.**

Find out more. Ask for ext. 98  
**1-800-538-3373**

In fact, by adding an Intel OverDrive Processor, your 486 PC will even run multiple Windows applications faster.

To check in to the OverDrive Processor, see your local computer dealer now.

Or for a detailed brochure, call 1-800-538-3373, ext. 98. And hurry. The vacancies are filling fast.

**intel**®

Circle 115 on Inquiry Card.



## Managing Infoglut

It was with ironic amusement that I gazed at your June cover story entitled "Managing Infoglut" as I readied myself to absorb the 426-page issue.

Marc W. Booth  
La Habra, CA

Bravo for Christopher Locke and the other toilers through the technological data dumps. Let's have more on how to add value.

Joseph A. Robinson  
San Francisco, CA

Your editorial and excellent articles on managing infoglut were right on target.

Sid Taylor  
Washington, DC

## Vexed Question

William F. Buckley Jr.'s "vexed question" ("Reflections on the 'Privacy' Question," June) is not so vexed when viewed not as a matter of privacy, but of the control of information. The presumption should be that the subject of the information has the right to see it and to decide who else sees it. By this principle, there is no conflict between protecting your tax records from the tabloids and having access to your own academic records (which Buckley sees as an invasion of the faculty's privacy, although justified in this case). This was, in fact, the principle applied to Buckley in the case of his medical records; Buckley had the right to deny the Physician Computer Network his records or to permit their use (as he did).

Bruce Lindsey  
Austin, TX

William F. Buckley Jr. brings up an interesting problem: the trade-off between privacy and the benefits of shared knowledge. He raises the issue of what has been called *query bracketing*, in which a sufficient number of queries to different databases can lead to a conclusion that violates privacy.

An existing algorithm mitigates this problem. In "Security Without Identification: Transaction Systems to Make Big Brother Obsolete" by David Chaum (*Communications of the ACM*, October 1985), Chaum discusses the use of digital pseudonyms to make database-to-database matching very difficult. For example, if a pharmacy, a test laboratory, and a doctor all use separate digital pseudonyms for the same person, and don't reveal the pseudonyms, privacy is maintained in the face of database query bracketing.

Paul E. Baclace  
Sausalito, CA

WE WANT TO HEAR FROM YOU. Address correspondence to Letters Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, send BIXmail c/o "editors," or send Internet Mail to letters@bytepb.byte.com. We edit letters for length and clarity.



## Internet Madness

In the June Software Corner, Ben Smith writes that it's tedious to wade through Usenet's 600 news groups. In fact, it's much worse than that. The University of Oslo (Norway) receives about 1900 news groups, the Royal Institute of Technology (Sweden) receives more than 1800, and the most central machine of Usenet, uu.net, carries more than 3300. It's been a long time since there were only 600 news groups on the Usenet.

Nicolai Langfeldt  
Asker, Norway

## FDDI Follow-Up

Rick Cook's "FDDI Follow-Ons? Gigabit Networks Coming" (June Microbytes, page 28) neglected to mention ATM, the CCITT standard cell relay protocol for high-speed networks. ATM has recently started to emerge from the laboratory onto the market in terms of components and end products at all levels of networking. ATM may emerge as the third-generation LAN, after CSMA/CD and FDDI (Fiber Distributed Data Interface), because it has been developed specifically to meet the needs of future high-speed heterogeneous networks and will form the basis of broadband ISDN. Finally, IBM's Packetized Lightwave Architecture Network, also mentioned by Cook, can handle both variable-size packets and fixed-size ATM-style cells. Given the implications for the future, perhaps it's time for BYTE to run a series on developments in high-speed networking.

Kevin Rowland  
Espoo, Finland

## WEB Wonder

Regarding WEB Technologies' DataFiles/16 ("Instant Gigabytes?," June Microbytes, page 45), the company claims to compress all files in excess of 16 to 1. Clearly, however, there are files that cannot be compressed that much.

Let's look at the mathematics. Each byte in a file can have any of 256 possible values, so there are  $256^n$  possible files of length  $n$  bytes. There are  $256^{1024}$ , or  $1.09 \times 10^{246}$ , possible files of length 1024, and  $2.60 \times 10^{157,826}$  files of exactly 64 KB.

The point is that, theoretically, only a relatively small number of files can be compressed by even 2 to 1. Admittedly, most of the files wouldn't make much sense if we are talking about, say, text. However, no one could claim that there are only  $1.09 \times 10^{246}$  files of all sizes that make sense. Yet that is essentially what WEB Technologies is claiming.

It's possible that some compression scheme might compress an average text file by 16 to 1 or more, but it would likely require a dictionary of the more common English words. Regardless, the task obviously requires a more sophisticated program to achieve greater compression rates. So a scheme to compress even the  $1.09 \times 10^{246}$  files of all lengths would doubtless take more memory



# We slash interface development time across DOS, UNIX, POSIX, VMS... (and we can prove it!)

**C-Programmers:**  
See for yourself how  
**Vermont Views™**  
can help you create  
powerful user  
interfaces—whatever  
your environment!

If you want to create sophisticated user interfaces—and save tremendous time and effort doing it—Vermont Views is exactly what you need.

Vermont Views isn't just a common interface package. It's a deep, flexible, menu-driven screen designer supported by a C library of over 580 functions. It lets you create the ultimate user interfaces for

complex database applications—in a fraction of the time it would take to code them yourself!

With Vermont Views, you create screens *interactively*. Designing is fast, and creative. And changes—both tiny adjustments and huge reworks—are incredibly easy.

Pull-down menus, window-based data-entry forms with tickertape or memo fields, scrollable form regions, choice lists, context-sensitive help...All these interface objects (and more) are immediately accessible. And with Vermont Views, even terminal-based applications can have the elegant features usually found only on micros.

## Fast prototypes, faster applications.

With most systems, you have to throw away your prototypes when coding begins. But with Vermont Views, *prototypes become the actual applications!*

Menus, data-entry forms, and all screen features are usable in the final applications without change. So not only do you avoid creating code from scratch once, you don't have to do it twice!

## It's the universal solution.

Vermont Views operates completely independent of hardware, operating system, and database.

Any interface you create can be ported easily among DOS,

UNIX, POSIX, and VMS.

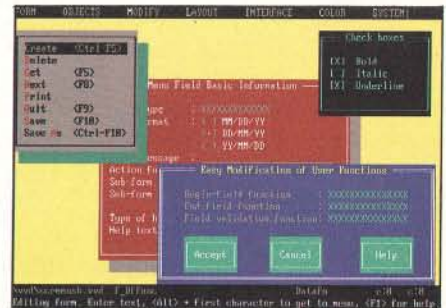
You can use Vermont Views with any database that has a C-language interface (including Oracle, Informix, db\_Vista, and C-Tree). You can run it on PCs, DEC, NCR, HP, AT&T, and other systems. You don't have to pay runtime fees or royalties. And full library source is available, too.

What's more, your DOS applications can have full mouse control, and work in



**Vermont  
Creative  
Software**

Pinnacle Meadows  
Richford, VT 05476 USA  
Phone: (802) 848-7731  
FAX: (802) 848-3502



graphics as well as text modes!

Don't take our word for it—put Vermont Views to the test. Call or fax now for your personal, free demonstration kit. Or order Vermont Views with our 60-day, money-back guarantee.

Either way, you'll see immediately that Vermont Views is a cut above the rest.

## Call for your FREE demo kit! 800-848-1248



**(Please Mention  
"Offer 345")**



than any computer has today.

In theory, there is no reason why you could not further compress a file that has already been compressed. However, you would eventually end up with a file that couldn't be compressed further, just based on the number of files of any given length. It may be that WEB found a scheme—like the fractal schemes for graphics—that allows a great deal of compression on certain file types. But there is no way that “virtually any amount of data can be compressed to under 1024 bytes.”

Steven V. Gunhouse  
Bowling Green, OH

*DataFiles/16 had not been released as this issue went to press. Company representatives still claim to be working on the product, but WEB Technologies' telephone has been disconnected.—Eds.*

## Expounding on SGML

The articles on SGML (Standardized Generalized Markup Language) in the Managing Infoglut State of the Art section (June) were very helpful. The HyTime standard was mentioned in passing in two of the articles, but I'd like to make the following points:

As of May 1, 1992, HyTime is an international standard (ISO/IEC 10744:1992). HyTime effectively extends SGML, creating an international standard for expressing the address of any information addressable by any means, including by means of any query in any query language or notation. It lets you express any set of relationships, including hyperlink relations, between any set of information objects addressed by any combination of means. And it lets you express the association of rendering instructions (e.g., temporal scheduling, spatial locations, and object modifiers) without arbitrary information objects.

In other words, there is now a standard for representing multimedia and hypermedia documents for certain kinds of layouts and even for project management schedules and dependencies. Now that HyTime has been finalized, these features can be exploited in the ISO Standard Music Description Language, now at the Committee Draft stage.

HyTime pioneers standardized object-oriented document representation by means of a new SGML technique, SGML Architectural Forms. These forms are templates for declaring SGML element types in actual SGML document type definitions. The potential significance of marrying SGML and object-oriented techniques and practices that HyTime represents can scarcely be overestimated.

HyTime has already been implemented in a prototype HyTime Engine developed by TechnoTeacher (Tallahassee, FL). Thus, John E. Warnock's debatable observation in “The New Age of Documents” (June) that the international standards process compromises the practicality or implementability of the standards it produces clearly does not apply to HyTime—or to SGML, for that matter.

The SGML User's Group publishes a newsletter that serves the needs of the HyTime user community. Contact SGML User's Group SIGhyper, c/o TechnoTeacher, Inc., 1810 High Rd., Tallahassee, FL 32303, (904) 422-3574, fax (904) 386-2562; Internet: SIGhyper@tecno.com.

Steven R. Newcomb  
Chairman, SGML User's Group SIGhyper  
Tallahassee, FL

## Mathcad vs. Mathematica

I was profoundly disappointed in your May review of Mathcad 3.0 (“What You See Is What You Solve: Mathematica and Mathcad for Windows”). The review contains sweeping generalizations and opinions, without indicating any particular biases of the reviewer.

For example, the statement that “Mathematica is certainly a hard act to follow, and Mathcad doesn't even try” indicates that the reviewer does not understand the market for each product. It's a misleading statement because Mathcad is not trying to follow Mathematica. Mathcad's positioning is quite different.

Mathcad is an easy-to-use, general-purpose productivity tool for the broad range of technical professionals who make up 90 percent of the technical market. This market ranges from electrical, chemical, mechanical, and civil engineers to students from middle school through higher education. Mathematica, on the other hand, is targeted to the other 10 percent of the technical market: primarily theoretical physicists who need to perform very complex and involved equations.

The reviewer cites as a negative Mathcad's display of equations using symbols (i.e., regular math notation), thereby sacrificing portability except for display purposes. The ability to work with equations the way they appear in a book and the ability to export equations that look like real equations are among the features that have made Mathcad the industry leader. Also, the reviewer is wrong in stating that Mathcad is not portable. Version 3.1 is quite portable and completely file compatible among Windows, Unix, and (soon) Macintosh. You can easily swap files transparently between environments.

David A. Blohm  
President and CEO  
MathSoft, Inc.  
Cambridge, MA

*The intention of the review—which I thought was highly favorable vis-à-vis Mathcad—was not to make a head-to-head comparison of Mathcad and Mathematica. In fact, I stated that Mathcad and Mathematica are not really comparable. Mr. Blohm misunderstood my statement about Mathematica being a hard act to follow. These are two very different products, aimed at different types of users; the review makes that point clearly. My objective was to bring out the main features and strengths of the two products, which are often lumped together in the same category of “math software.”*

*It is true that Mathcad 3.1 is quite portable and completely file compatible across platforms. Editors at BYTE were briefed on the changes coming with 3.1, but the review went to press before 3.1 was available. A summary of Mathcad 3.1 subsequently appeared as a News item in June.—Nicholas Baran*



The correct telephone number for MicroNet Technology, Inc. (“The BYTE Lab Tests Six Disk-Array Subsystems,” August) is (714) 837-6033; fax (714) 837-1164. ■



# VALUE



*Omron's portable fax/modem  
weighs only 4.2 oz.*

# PACKED.



When you decide to buy a portable fax/modem, you may be surprised by everything else you need to buy. 🦋 To get the fax/modem to actually work, you have to shop for additional expensive software. 🦋 Why doesn't someone put everything you need in a single box? 🦋 They have. The new

*Runs up to 12 hours  
on batteries.*

ergonomically designed Impala™ fax/modem from Omron gives you three top rated Windows and DOS software packages from Delrina and Bit. An AC adapter. Cables. Absolutely everything you need. In a single box. 🦋 So why shop around when you can get over \$300 of extra value *free* with Impala!

## OMRON®

FREE COMPUSERVE OFFER FROM OMRON. CALL FOR DETAILS.

**CALL 1-800-362-4411 FOR THE DEALER NEAREST YOU.**

© 1992 OMRON OFFICE AUTOMATION PRODUCTS, INC. IMPALA IS A TRADEMARK OF



OMRON, INC. OTHER PRODUCTS ARE TRADEMARKS OF THEIR RESPECTIVE HOLDERS.

**Circle 215 on Inquiry Card.**



# All the power of a desktop. And a lot better mileage.

You've dreamed about a computer like this.

One that would have power and display capabilities equal to, or greater than, the desktop computer you're using now.

One you could take along to all of those different places you need to work.

One you wouldn't need a furniture dolly to move.

And here it is.

The Toshiba T6400.

With dimensions of 15.4" W x 10.5" D x 3.3" H (4.1" H with the color screen), it's small enough to fit in a briefcase.

With a spirited clock speed of

*In addition to a 1.44MB floppy drive, you can choose a 120 or 200MB hard disk.*



an impressive office building.

And if a combination like that doesn't make the T6400 portable better than the desktop computer you're currently using, we'll eat our collective hat.

This remarkable machine comes equipped with an internal 1.44MB, 3½" floppy drive and a



*The 101-key keyboard, connected to the CPU by a coiled cord, can be removed from the case.*

120 or 200MB hard disk. Plus 4MB RAM, expandable to 20MB. (Try finding any application that needs more memory than that.)

There's also a full-length, IBM-compatible, 16-bit expansion slot so you can take full advantage of your network card, SCSI controller or any of a myriad of other special purpose cards.

For even more expandability the T6400 comes complete with a 150-pin expansion port for

direct input/output to the CPU, enabling you to connect storage and communications devices. Plus an internal dedicated



*The AC-powered T6400 has full desktop expandability, including an IBM-compatible, 16-bit expansion slot.*

modem slot, as well as built-in parallel, serial, mouse and Super VGA video ports.

Depending on your particular needs, you can choose one of two display screens.

A state-of-the-art active matrix Super VGA color display with Thin Film Transistor technology, to deliver a higher quality image than you can get with most desktop monitors, and capable of displaying 256 simultaneous colors at 640x480 resolution.

Or a gas plasma display featuring 16 gray scales, also at 640x480 resolution, and a 100:1 contrast ratio—seven times the contrast of standard LCD displays, with ten times the display speed.

Both have a diagonal measure of 10.4" and provide simultaneous viewing capability with external Super VGA displays.

To complete the T6400's amazing metamorphosis from desktop to portable, we too a 101-key keyboard





with full-size keys and key spacing, separate numeric keypad and eight dedicated cursor control keys, and nestled it into a compact 11.7 lb. package (12.9 lbs. with color screen). Then attached it to the CPU with a coiled cord, so you can remove

it and use it on your lap (or other convenient surface).

Now, having read all of the above, you'd probably welcome more information on the T6400. If so, call us at 1-800-457-7777.

The more you learn about our products the more you'll come to

understand the Toshiba philosophy: that portables are the future of personal computing.

Of course, with the introduction of the T6400 portable, it's a future that's already here.

In Touch with Tomorrow  
**TOSHIBA**



## Intel Reveals Tantalizing P5 Details

**W**hen Intel's P5 microprocessor is released early next year, the new chip will maintain full compatibility with the 486 and eventually deliver four to 10 times the performance, claim Intel engineers. Thanks to its superscalar architecture, parallel-integer pipelines, intelligent branch predictions, and improved floating-point math, the first version of the P5 will crunch more than 100 MIPS at its clock speed of 66 MHz. That's about twice as fast as a 66-MHz 486DX2.

These and other details of the P5 were revealed at Stanford University's Hot Chips Symposium this summer. Cautious and cagey, two Intel engineers prefaced their talks with legal statements mandated by corporate attorneys and were sometimes hissed at for dodging technical questions. But the eager audience of engineering students and observers from rival companies got a tantalizing glimpse at the inner workings of the new CPU.

While the 486 uses 1-micron technology to pack 1.2 million transistors on a chip, the P5 uses 0.8-micron technology and has 3 million transistors. Although the P5 is the successor to the 486, it won't be called the 586. Instead, Intel is running a contest for employees to suggest a new name.

At Stanford, one of Intel's presentations revealed that the P5's integer pipeline resembles that of the 486, but it is split into two parallel pipes. After prefetching and partially decoding an instruction, the P5 decides if the instruction can be executed in parallel with the next instruction that follows. If the P5 doesn't detect any dependencies, the two instructions are dispatched along parallel pipes for execution.

An instruction-issue algorithm in the P5 dispatches consecutive instructions along separate pipes only if the instructions meet the following conditions: both are considered simple instructions (mostly ALU, JUMP, and MOV operations), the first instruction is not a JUMP, and the destination of the first instruction is neither the source nor the destination of the second instruction. Intel says that more than 30 percent of all instructions meet these conditions and execute in parallel. Although that may not sound impressive, the theoretical limit is 50 percent—that is, if half of all instructions were dispatched along each of the two pipes.

Two other key parts of the integer unit are a branch target buffer and a dual-access data cache. The branch target buffer predicts the outcome of branches; if correct, the branch executes without delay. Intel says the penalty for incorrect predictions is more than offset by the hits. The dual-access cache handles both data and addresses from the twin pipes and contains logic for resolving address dependencies.

The FPU has three dedicated arithmetic units—a multiplier, a divider, and an adder—plus an eight-stage pipeline that's integrated with the integer pipeline but includes two more execution stages. Although all floating-point computations execute in a single pipe, they work concurrently with the dual-access cache. As a result, the pipeline achieves one-cycle throughput. Under certain conditions, the FPU may stall for three cycles. However, Intel says these exceptions are so rare that none occurred in the SPECmark benchmark.

Although the FPU is tuned for double-precision memory-to-register operations (the most common type expected), Intel says that single-precision and register-to-register operations are just as fast. New algorithms for transcendental computations are said to yield results that are more correct than previous Intel FPUs.

For backward compatibility, the P5 maintains the 80x86 eight-register stack and uses the top register as an accumulator. To avoid logjams, the registers are shuffled by executing the FXCH (F-exchange) instruction in parallel with other operations. This ensures that the next value to be manipulated always resides at the top of the stack.

—Tom R. Halfhill

## NANOBYTES

It was a day in July of surprising announcements: Texas billionaire Ross Perot announced he would not run for the office of president of the U.S., and Ken Olsen, co-founder and president of DEC (Maynard, MA), shocked the industry by announcing he would retire effective October 1. (A week later, DEC announced it had absorbed an operating loss in its fiscal fourth quarter of about \$188 million, and it would also take for that quarter a restructuring charge



of \$1.5 billion.) DEC's board of directors has approved **Robert Palmer** to succeed Olsen as the head of the company.

Palmer, co-founder of chip start-up Mostek and recently the head of DEC's computer chip division, will assume the title of president and CEO. Pier Carlo Falotti, president of DEC's European operations, also resigned from DEC. □

More employee layoffs and plant closings are on the way for **DEC**. Analysts estimate the company will lay off between 15,000 and 20,000 people. Nikki Richardson, manager of DEC's corporate information group, said that DEC plans to reduce its total occupied floor space by an extra 2 million sq. ft. this year, an area that is equivalent to about 35 U.S. football fields, including the end zones. □

DEC has licensed **Cambridge**, U.K.-based IXI's X.Desktop, a desktop manager for the X Window System. DEC intends to ship the package on all its workstation products, including systems running Ultrix and OSF/1. □



# Delivering the Power: WATCOM C9.0/386

► **The Widest Range of 32-bit Intel x86 Platforms**  
32-bit DOS, 32-bit Windows, OS/2 2.0, AutoCAD ADS

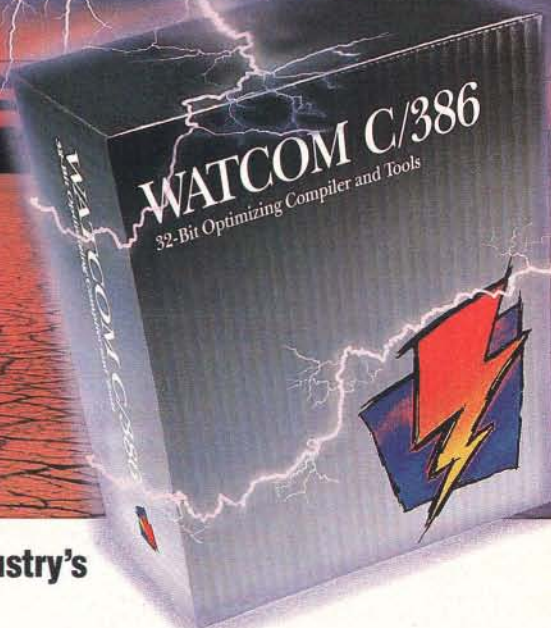
► **The Industry's Leading Code Optimizer**

Advanced global optimizer with new 486 optimizations

► **The Most Comprehensive Toolset**

Debugger, profiler, protected-mode compiler and linker,  
32-bit DOS extender with royalty-free run-time, licensed  
components from Microsoft SDK, and more

► **The Best Value in 32-Bit Tools: \$895\***



## Unleash 32-bit Power!

WATCOM C9.0/386 lets you exploit the two key 32-bit performance benefits. The 32-bit flat memory model simplifies memory management and lets applications address beyond the 640K limit. Powerful 32-bit instruction processing delivers a significant speed advantage: typically at least a 2x speedup.

### You Get:

**100% ANSI and SAA compatible:** C9.0/386 passes all Plum Hall Validation Suite tests  
**Extensive Microsoft compatibility** simplifies porting of 16-bit code  
**Royalty-free** run-time for 32-bit DOS, Windows and OS/2 apps  
**Comprehensive toolset** includes debugger, linker, profiler and more  
**DOS extender** support for Rational, Phar Lap and Ergo  
**Run-time compatible with WATCOM FORTRAN 77/386**

**32-bit DOS** support includes the DOS/4GW 32-bit DOS extender by Rational Systems with royalty-free runtime license

► Virtual Memory support up to 32Mb

**32-bit Windows** support enables development and debugging of 32-bit GUI applications and DLL's.

► Includes licensed Microsoft SDK components

**32-bit OS/2 2.0** support includes development for multiple target environments including OS/2 2.0, 32-bit DOS and 32-bit Windows

► Access to full OS/2 2.0 API including Presentation Manager

► Integrated with IBM Workframe/2 Environment

**AutoCAD ADS and ADI** Development: Everything you need to develop and debug ADS and ADI applications for AutoCAD Release 11

**Novell's** Network C for NLN's SDK includes C/386

## The Industry's Choice.

**Autodesk**, Robert Wenig, Manager, AutoCAD for Windows:

"At Autodesk, we're using WATCOM C/386 in the development of strategic new products since it gives us a competitive edge through early access to new technologies. We also highly recommend WATCOM C/386 to third party AutoCAD add-on (ADS and ADI) developers."

**Fox Software**, David Fulton, President: "FoxPro 2.0 itself is written in WATCOM C, and takes advantage of its many superior features. Optimizing for either speed or compactness is not uncommon, but to accomplish both was quite remarkable."

**GO**, Robert Carr, Vice President of Software: "After looking at the 32-bit Intel 80x86 tools available in the industry, WATCOM C was the best choice. Key factors in our decision were performance, functionality, reliability and technical support."

**IBM**, John Soyryng, Director of OS/2 Software Developer Programs: "IBM and WATCOM are working together closely to integrate these compilers with the OS/2 2.0 Programmer's Workbench."

**Lotus**, David Reed, Chief Scientist and Vice President, Pen-Based Applications: "In new product development we're working with WATCOM C because of superior code optimization, responsive support, and timely delivery of technologies important to us like p-code and support for GO Corp's. PenPoint."

**Novell**, Nancy Woodward, V.P. and G.M., Development Products: "We searched the industry for the best 386 C compiler technology to incorporate with our developer toolkits. Our choice was WATCOM."

## WATCOM

**1-800-265-4555**

**The Leader in 32-bit Development Tools**

415 Phillip Street, Waterloo, Ontario, Canada. Telephone: (519) 886-3700, Fax: (519) 747-4971. \*Price does not include freight and taxes where applicable. Authorized dealers may sell for less. WATCOM C and Lightning Device are trademarks of WATCOM Systems Inc. DOS/4G and DOS/16M are trademarks of Rational Systems Inc. Other trademarks are the properties of their respective owners. Copyright 1992 WATCOM Products Inc.



Circle 190 on Inquiry Card.





## DOS Programs - Icon View



Harvard Graphics



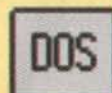
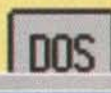
Quicken



Peachtree Accounting



CA-SuperCalc



Quattro Pro



OS/2 System



Master Help  
Index



## Windows Programs - Icon View



PageMaker



Ami Professional



CA-dBFast



WordPerfect



## OS/2 Programs - Icon View



CorelDRAW!



Accounting Vision/32



PC/Data Access  
Control System



DeScribe



Enfin/3



ObjectVision



PFS: Works



Publisher's  
Paintbrush

# OS/2

\*In Canada, call 1 800 465-7999. \*\*Upgrade from Windows, \$79; upgrade from any DOS, \$99; \$149 base operating system. These prices valid only when ordered directly through IBM. Proof of purchase required. Dealer prices may vary. Offer valid in U.S.A. only, expires 10/31/92. Shipping and handling not included. IBM and OS/2 are registered trademarks and Workplace Shell is a trademark of International Business Machines Corporation. All other products are trademarks of their respective corporations. ©1992 IBM Corp.





Start Here



Information



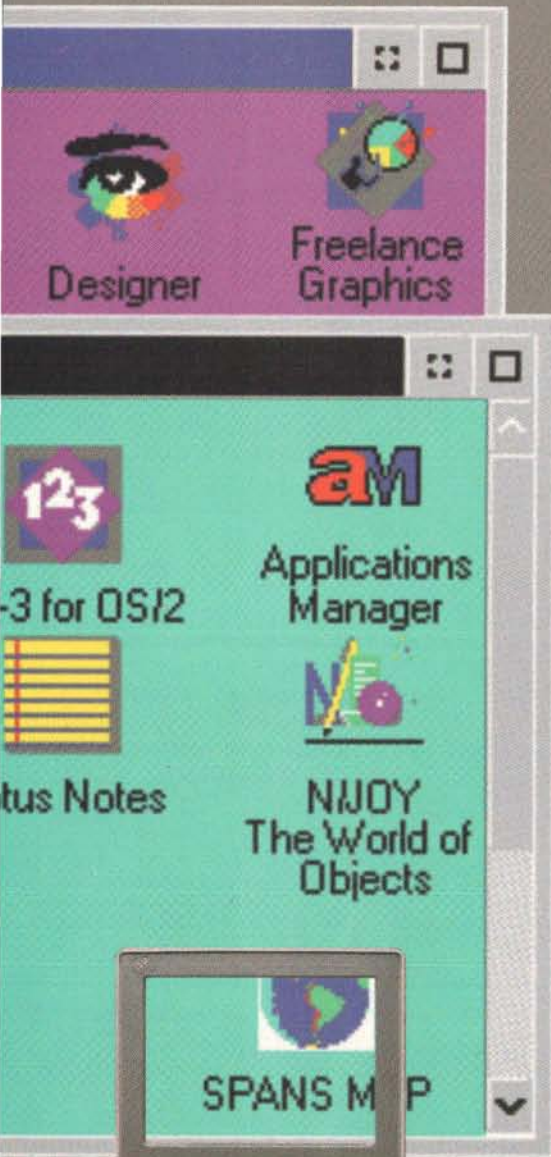
IBM Laser  
Printer



Shredder

# There's a place in this world for DOS and Windows.

## And you're looking at it.



OS/2® 2.0 isn't about leaving your DOS and Windows™ applications behind. It's about moving them ahead—doing more with them than ever before.

Now you can run DOS, Windows and OS/2 applications at the same time, in separate windows on the same screen. Create a new letter while using your fax/modem. Print charts as you calculate a complex spreadsheet. Even “cut and paste” between *any* applications—and more. But OS/2 doesn't just enhance your current applications. It protects your investment in them. And preserves your choices as more become available, including new 32-bit applications.

But maybe the best part is that for less than the cost of DOS and Windows, you get the capabilities of both. Plus all the added benefits of OS/2 2.0—including Adobe Type Manager.™ So with OS/2 2.0, whatever applications you use, you've come to the right place. For an IBM authorized dealer near you, or to order OS/2 2.0 from IBM—at special promotional prices of \$79 for Windows users and \$99 from any DOS—call 1 800 3-IBM-OS2.\*



## Introducing OS/2 2.0.

- Runs DOS, Windows and OS/2 applications from a single system.
- Supported on most IBM-compatible 386 SX PCs and above.
- Up to 48MB expanded memory per application. No 640K limit.
- Workplace Shell™: an easy-to-use, graphical interface.
- OS/2 2.0 upgrade: \$79 from Windows, \$99 from any DOS.\*\*

Circle 112 on Inquiry Card.



## Intel's User Upgrade: A ZIF Socket Helps

Intel wants end users to join the upgrade fun, too. Unlike Intel's DX2 processors, which are targeted at PC manufacturers, Intel is selling the newest addition to its Overdrive product line through the retail channel. The Speed Doubler 25-50, a clock-doubler chip, directly replaces 25-MHz 486SX or 486DX processors. Unlike earlier members of the Overdrive family, this chip does not require a separate vacant Overdrive socket. It is user installable and directly replaces the existing 486DX or 486SX chip. Intel will sell the new Overdrives at \$699 (50-MHz version) and \$899 (66-MHz version).

Despite Intel's claims of an easy installation process, the 50-MHz direct Overdrive processor isn't always the type of upgrade you'd want to undertake yourself. Removing the massive 486 chip, even with the special chip puller that Intel provides, is a job best left to an experienced technician, especially if your system is not built with a ZIF (zero-insertion force) socket; otherwise, you could damage your processor or motherboard.

The 486DX Overdrive won't be suitable for every PC; you should verify at your local computer store that your system has been certified. Also make sure

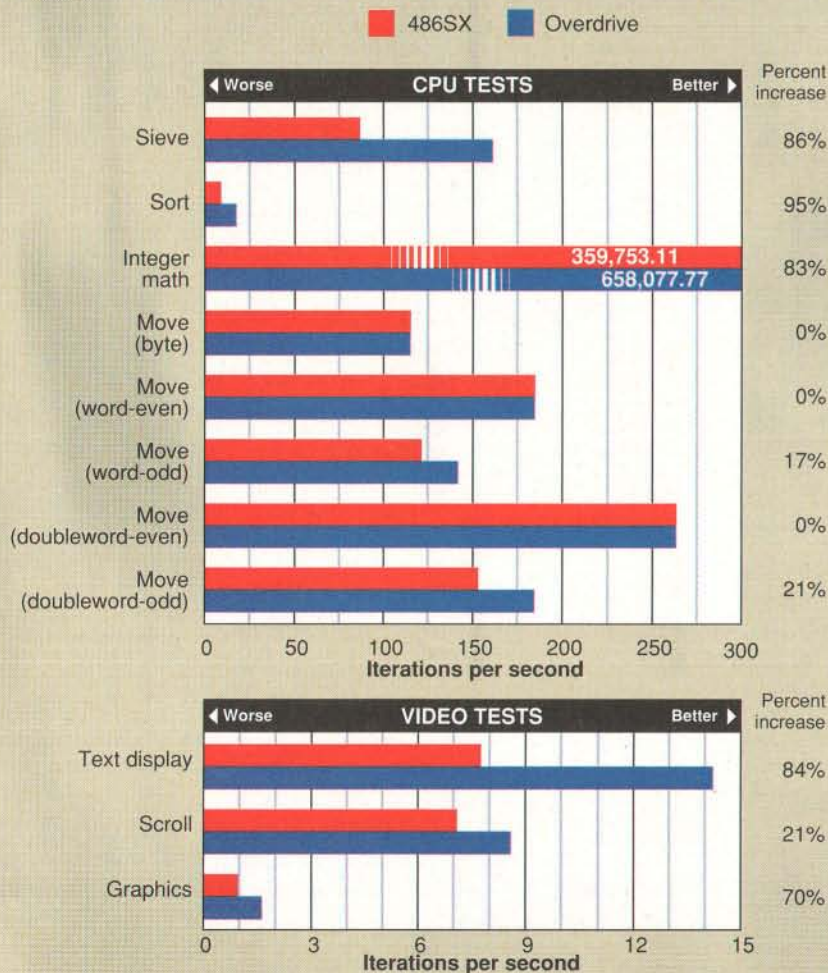
## NANOBYTES

Judging by the exhibits at the August MacWorld Expo, any preaching that Apple does to users about the benefits of its QuickTime file format will be preaching to the choir. At the show, practically every demonstration of a multimedia or an animation product trumpeted the product's QuickTime compatibility. QuickTime will soon begin appearing on other platforms as well. As reported in the August Microbytes, Silicon Graphics is supporting QuickTime on the Indigo workstation. Apple also showed a Windows player for QuickTime.

In keeping with the cross-platform compatibility theme for QuickTime, Apple will work with Avid Technology (Tewksbury, MA), a leader in digital media for broadcast-level video production. Avid and Apple said that they will work to eventually converge Apple's QuickTime and Avid's Open Media Framework to provide a single media-integration standard. OMF provides a standard for moving professional-quality digital video with accompanying audio through a network in a device- and system-type-independent format. Endorsed by 30 vendors, including Silicon Graphics, Avid first announced OMF in April at the National Association of Broadcasters convention. □

Du Pont Pixel, the maker of high-end hardware and software for accelerating 3-D graphics and image-processing operations on Sun Sparcstations, announced at SIGGRAPH '92 that it has ported Silicon Graphics, Inc.'s famed Iris GL 3-D programmer's interface to SPARC systems. Developers can recompile programs written for SGI's workstations using the Sun compilers and the Du Pont Pixel library. Nth Graphics (Austin, TX) also offers a solution for porting applications to SPARC platforms. Bill Glazier, manager of graphics technology licensing at SGI, said over 20 major vendors have now licensed Open GL. □

### BENCHMARKS FOR SPEED DOUBLER 25-50



The BYTE Lab benchmarked the DX Overdrive on a Dell 486D/25, which does not contain secondary cache (the Overdrive processor delivers the best results in systems with at least 64 KB of secondary cache). Higher numbers indicate better performance.



**WORLD PROCESSING**

⇒ WordPerfect® speaks 31 languages, including four versions of English. It can process words from left to right or right to left or top to bottom. And if you count 12 kinds of UNIX as one, it supports 10 different computer platforms. 🖨 To become the world's most popular word processor, a program has to be fluent in the languages of people as well as the languages of computers. 👁 Oh yes, and there's one other thing. ✌ It has to be really good.

# WordPerfect®

FOR INFORMATION CALL 801-225-5012

Circle 194 on Inquiry Card.





# 1.800.8

## Your Natural Resource



### Keyboards



- 8088/286/386/486 compatible
  - Automatically switch between XT or AT
  - One-year warranty
- | Part No. | Product No. | Description                                 | Price   |
|----------|-------------|---|---------|
| OB17128  | FKB4700     | Fujitsu 101-key enhanced keyboard           | \$79.95 |
| OB17136  | FK5001      | 130-key enhanced keyboard with calculator   | \$99.95 |
| OB20474  | JE2018      | 32-key serial keypad                        | \$59.95 |
| OB67432  | K101        | 101-key enhanced keyboard (90-day warranty) | \$49.95 |

OB17128

### Power Supplies

- One-year warranty

Part No.	Product No.	Description	Price
OB19465	JE1030	150 watt 8088	\$69.95
OB67467	JE1030A	200 watt 8088	\$89.95
OB19545	JE1036	200 watt 286/386/486	\$89.95
OB19570	JE1038A	250 watt 286/386/486	\$99.95
OB65728	JE1039A	300 watt 286/386/486	\$149.95



OB19465

### KaLok Hard Disk Drives

- 90-day warranty

Part No.	Product No.	Description	Price
OB22322	KL320	20MB MFM hard drive	\$169.95
OB22331	KL330	30MB RLL hard drive	\$189.95

Call for information on controller cards.

### Hard Drives (IDE)

Conner IDE

- 8088/286/386/486 compatible
- Requires host IDE adapter
- One-year warranty



Part No.	Product No.	Capacity	Speed	Price
OB14058	CP3000	40MB	25ms	\$249.95
OB14066	CP30084	80MB	25ms	\$359.95
OB14074	CP30104	120MB	19ms	\$429.95
OB14120	CP3204	200MB	16ms	\$699.95

### Controllers

IDE Disk Drive Adapter Cards

#### Standard Features:

- Interfaces two IDE hard drives to system
- One-year warranty



OB10268

Part No.	Product No.	Description	Price
OB10233	ADP20	16-bit hard adapter	\$29.95
OB10250	ADP20F	16-bit hard/floppy adapter	\$39.95
OB10268	ADP50	8-bit hard adapter	\$79.95
OB10276	ADP60	16-bit hard adapter with BIOS	\$79.95
OB10284	ADP60F	16-bit hard/floppy adapter with BIOS	\$99.95

### Tool Kit

Computer Service

- (2) Slotted screwdrivers: 1/8", 3/16"
- (2) Phillips screwdrivers: #0, #1
- (2) Nutdrivers: 3/16", 1/4"
- (2) Torque screwdrivers: T-10, T-15
- 14-16 pin IC inserter/straightener
- 3-claw parts holder
- 14-40 pin IC extractor
- Tweezers
- Black vinyl carrying case



Part No.	Product No.	Price
OB14189	CSK8	\$19.95

### Jameco Power Base

- Masterpower switch and 5 auxillary switches for each outlet
- 15A, 125 VAC, 60Hz
- Maximum spike: 80 joules one time
- Maximum spike volts: 6,000V
- Clamp volts: 175V
- Clamping response time: 10ns
- Color: beige



Part No.	Product No.	Price
OB20159	JE1190	\$29.95

### Jameco Six-Outlet Power Strip

- Built-in safety circuit breaker (15 amps)
- Master switch with pilot light
- Three-prong, 6-foot power cord
- UL listed

Part No.	Product No.	Price
OB20175	JE1191	\$11.95

### Floppy Disk Drives

Toshiba 1.44MB  
3.5" Internal Floppy Disk Drive

- 8088/286/386/486 compatible
- One-year warranty

Part No.	Product No.	Price
OB40774	356KU	\$99.95



### Additional Internal Floppy Disk Drives

- One-year warranty

Part No.	Product No.	Description	Price
OB17099	FD55B	5.25" TEAC 360KB	\$89.95
OB17101	FD55G	5.25" TEAC 1.2MB	\$99.95

### Floppy Controllers

- One-year warranty

Part No.	Product No.	Description	Price
OB19617	JE1043	88/286/386/486 two-drive	\$49.95
OB19668	JE1049	88/286/386/486 four-drive	\$59.95



# 31•4242

## Only A Phone Call Away



**Announcing  
JAMECO  
ServiceLine™**  
Computer Repair  
and Support  
1-800-831-8020

### Jameco Solderless Breadboards



Jameco's long-lasting breadboards feature screen-printed color coordinates and are suitable for many kinds of prototyping and circuit design. Larger models feature a heavy-duty aluminum backing with voltage and grounding posts.

Part No.	Product No.	Dim. L" x W"	Contact Points	Binding Posts	Price
OB20600	JE21	3.25 x 2.125	400	0	\$4.95
OB20722	JE23	6.50 x 2.125	830	0	\$6.95
OB20757	JE24	6.50 x 3.125	1,360	2	\$12.95
OB20773	JE25	6.500 x 4.25	1,660	3	\$17.95
OB20790	JE26	6.875 x 5.75	2,390	4	\$24.95
OB20811	JE27	7.250 x 7.50	3,220	4	\$32.95

### Metex Digital Multimeters



- Handheld, high accuracy
- Measures AC/DC voltage, AC/DC current, resistance, diodes, continuity, and transistor current gain (except 27140)
- Manual ranging w/overload protection
- Comes with probes, batteries, case and manual
- **OB27086 & OB27158 only:**
- Also measures frequency and capacitance

Part No.	Product No.	Description	Price
OB27115	M3800	3.5 digit multimeter.....	\$39.95
OB27078	M3610	3.5 digit multimeter.....	59.95
OB27140	M3900	3.5 digit multimeter with tach/dwell.....	59.95
OB27086	M3650	3.5 digit multimeter w/ frequency & capacitance.....	74.95
OB27158	M4650	4.5 digit w/frequency & capacitance & data hold switch.....	99.95

## JAMECO

### ELECTRONIC COMPONENTS

### COMPUTER PRODUCTS

1355 Shoreway Road, Belmont, CA 94002

**Sales: 1-800-831-4242**  
Outside US: 415-592-8097  
**FAX: 1-800-237-6948**

Jameco ServiceLine™: 1-800-831-8020  
Technical Support: 1-800-831-0084



### Motherboards

**Jameco 80386  
64KB Cache Motherboard**

**Now Available  
with MS-DOS  
& Windows!**



- 33MHz motherboard
  - Supports up to 32 MB of RAM on-board
  - Supports 64KB, 128KB or 256KB direct mapped cache RAM
  - Six 16-bit slots and two 8-bit slots
  - One-year warranty
- | Part No. | Product No. | Description   | Price    |
|----------|-------------|---|----------|
| OB21354  | JE3633      | 80386 33MHz motherboard .....                               | \$459.95 |
| OB65998  | JE3633MS    | 80386 33MHz motherboard with MS-DOS 5.0 and Windows 3.1.... | \$79.95  |

### Additional Jameco Motherboards

- One-year warranty
- | Part No. | Product No. | Description                     | Price    |
|----------|-------------|---------------------------------|----------|
| OB53882  | JE3616SN    | 80386SX 16MHz motherboard ..... | \$209.95 |
| OB20941  | JE3006      | 80286 12MHz motherboard .....   | 124.95   |
| OB67521  | JE1002BE    | 8088 10MHz motherboard .....    | 69.95    |

Call for additional software options and information on our 386 and 486 computer kits!

### Memory



Expand your memory. See our excellent selection at low prices for all types of RAM. Jameco also offers memory modules for Apple, AST, Compaq, Epson, IBM, Hewlett-Packard and Toshiba computers.

#### DIP

Part No.	Product No.	Pins	Function	Price
OB41398	41256-120	16	256K 120ns.....	\$1.69
OB41427	41256-150	16	256K 150ns.....	1.59
OB42251	511000P-80	18	1MB 80ns.....	5.99
OB42219	511000P-10	18	1MB 100ns.....	5.49

#### SIPs and SIMMs

Part No.	Product No.	Function	Price
OB41451	41256A9A-10	256K SIP 100ns .....	\$18.95
OB41523	41256A9B-80	256K SIMM 80ns .....	16.95
OB41718	421000A9A-80	1MB SIP 80ns .....	54.95

Call for additional information on our selection of memory chips and modules.

### Computer Cards



#### 16-bit VGA Card

- 8088/286/386/486 compatible
- Comes with 256KB video RAM expandable to 512KB
- Capable of 640 x 480 with 256 colors, 800 x 600 with 256 colors, 1024 x 768 with 16 colors (512KB RAM required for all modes)
- One-year warranty

Part No.	Product No.	Price
OB67459	VG7700	\$99.95

#### Additional Cards

Part No.	Product No.	Function	Price
OB19596	JE1040	8088 floppy controller .....	\$19.95
OB19705	JE1050A	8088/286/386/486 monochrome graphics adapter .....	49.95
OB19781	JE1058S	8088/286/386/486 Super VGA ....	159.95
OB19801	JE1060	8088 I/O .....	49.95
OB19828	JE1062	8088/286/386/486 RS232 serial (16450 UART).....	29.95
OB67053	JE1062A	8088/286/386/486 RS232 serial (16550 UART).....	39.95
OB19844	JE1065	80286/386/486 I/O .....	49.95
OB19895	JE1075	8088 multi I/O w/floppy controller .....	69.95
OB19908	JE1076	80286/386/486 multi I/O .....	69.95
OB19975	JE1080	8088 memory expansion half card..	49.95
OB29313	RAMQUEST	8088/286/386/486 Orchid 32MB memory card .....	154.95

### Cables, Gender Changers, and Adapters



Part No.	Product No.	Description	Price
OB28716	PPC6	6-foot parallel DB25-pin male to Centronics male printer cable .....	\$7.95
OB28708	PPC12	12-foot parallel DB25-pin male to Centronics male printer cable .....	10.95
OB31721	SAT6	6-foot 9-pin serial DE9 female to DB25 male cable .....	5.95
OB39511	25M10F	10-foot DB25-pin male to female cable extension .....	9.95
OB39538	25M10M	10-foot DB25-pin male to male cable extension .....	9.95
OB18420	GC25F	DB25-pin female slim line gender changer.....	4.49
OB18446	GC25M	DB25-pin male slim line gender changer .....	4.49
OB10305	AD925	DE9 female to DB25 male serial adapter.....	4.95
OB10321	AD926	DE9 male to DB25 female serial adapter.....	4.95

## GET A FREE JAMECO CATALOG

## CALL 1-800-637-8471

MENTION MAIL KEY OB2



your system has good air cooling (the clock-doubled Overdrive dissipates about 1 W of extra heat over that of the older CPU).

The figure shows the performance improvement achieved by the Speed Doubler 25-50 over the standard 25-MHz 486SX processor. Most noticeable is the complete lack of improvement in the Move test, which is bound by chip I/O, because minimal calculations are performed on-chip.

Performance improvements will depend on the application. Programs bound by

data transfer (e.g., a desktop publishing program that often needs to refresh the screen over the system bus) will see little or no improvement. Compute-bound applications (e.g., a spreadsheet program doing a recalc) will see a significant improvement. If you're running a 486SX and need floating-point math, the new Overdrive processor is a much better value than a 487SX.

—Raymond GA Côté and  
John Donovan

## Judge Affirms Look-and-Feel Decision

**S**AN FRANCISCO—Apple lost again in its \$5.5 billion lawsuit against Microsoft and Hewlett-Packard over the Mac interface when U.S. District Judge Vaughn Walker reaffirmed his April 14 ruling that most aspects of Microsoft Windows and HP's NewWave do not illegally copy Apple's GUI.

In a detailed 75-page opinion released in August, Judge Walker said the similarities between Windows, NewWave, and the Mac either do not violate U.S. copyright law or are covered by a 1985 agreement, in which Apple allowed Microsoft to borrow certain elements of the Mac's screens for Windows 1.0. The affirmation

seems to dash Apple's hopes of winning a victory against Microsoft and HP.

Shortly after his August decision, Judge Walker conducted a lengthy conference call with attorneys from all three companies. The attorneys were invited to submit additional briefs to the court by August 31; at press time, all three companies were expected to take advantage of the opportunity. Each side was to have until September 14 to respond to the other side's arguments. Afterward, Judge Walker is expected to render another opinion, which may lead to a final resolution of the four-year-old lawsuit.

—Tom R. Halfhill

## Bell Rings for Software Copyright Law

**A** federal judge has ruled that Borland International's Quattro Pro spreadsheet program infringes on Lotus Development's copyrights of the 1-2-3 spreadsheet program and that a trial by jury is now needed to determine the extent of the copying. Borland, which was expected to appeal the decision, announced shortly after the decision that it is shipping a new version of its Quattro Pro spreadsheet that lacks the optional 1-2-3 interface.

U.S. District Court Judge Robert E. Keeton scheduled a pretrial conference for September 23 and a tentative trial date for November 2. Hank Gutman, partner at O'Sullivan Graev & Karabell and lead counsel for Lotus in the lawsuit, said in a press conference that the few remaining issues along with damages will likely be addressed in the jury trial. New Quattro Pro buyers can still order 123.mu at a nominal charge.

Judge Keeton's ruling appears to conflict with the one handed down in the U.S. Court of Appeals for the Second Circuit (Manhattan, NY) in a case between Altai and Computer Associates International.

That ruling said that copycat programs that closely mimic the structure of older software programs do not violate copyrights.

"The whole area is totally confused. Somebody has to sort this out," said Ronald Abramson, intellectual property counsel with the New York firm Hughes, Hubbard & Reed. But who will hang the bell on the proverbial cat: the U.S. Congress or the Supreme Court? "Legislation might be a mistake," Abramson said. "If someone writes legislation, we'll be in court again for the next 15 years trying to decide what [the new law] means." He said the best hope of resolving this issue is that the Supreme Court will finally accept and review one of these cases. The Borland/Lotus or Apple/Microsoft/Hewlett-Packard cases are likely candidates for review because they are easier to follow and more sharply defined than the CA/Altai case, Abramson said. If the Supreme Court were to accept one of the cases, a decision wouldn't likely come down before October 1994.

—David Andrews and  
Tom R. Halfhill

## NANOBYTES

During a panel discussion at the recent Object World conference in San Francisco, executives from five companies traded barbs and



debated their different approaches, and **Steve Jobs**, president and CEO of Next Computer, came out on top. Although the panelists were sup-

posed to discuss "The Strategic Role of Object Technology for the Software Industry," they all but abandoned the scheduled topic and took advantage of the forum to demonstrate new products, make announcements, and take shots at each other. Microsoft's James Allchin, vice president of advanced systems, became the first victim shortly after demonstrating an early version of Cairo, the Windows-like object-oriented operating system projected for release in about two years. Allchin's demonstration was marred when his portable computer crashed, forcing him to reboot the system through MS-DOS. "If it takes Microsoft 10 years to get rid of the mess when you boot, why should we believe that you can make Windows easy to program in only two years?" mocked Jobs. "Can the horse evolve into the automobile?" □

Jobs pulled no punches when he demonstrated **NextStep 3.0**, the latest version of the Next operating system slated to ship in September. Dismissing his competitors' products as vaporware, Jobs said the Next system is the leading object-oriented computer on the market. Microsoft's Allchin protested atop Unix and Mach—is not a true object-oriented operating system and that NextStep 3.0 was originally scheduled to be released in June. "OK, so we slipped 60 days," Jobs responded, "but at least we have a product to slip." □



```

FUNCTION POPADDR
PARAMETERS NAME
PRIVATE ADDRESS, ZIP CODE, CITY
ADDRESS = SPACE (30)
ZIP CODE = 0
CITY = SPACE (30)
SET COLOR TO W/N
CLEAR SCREEN
@ 2,10 SAY NAME
@ 3,10 SAY "Address"
@ 4,10 SAY "Zip"
@ 5,10 SAY "City"
@ 3,30 GET ADDRESS
@ 4,30 GET ZIP CODE PICTURE "99999"
@ 5,30 GET CITY
READ
RETURN .T.

```

```

FUNCTION POPADDRS (NAMES)
ADDRESS$ = ""
ZIP CODE = 0
CITY$ = ""
COLOR 7,0
CLS
LOCATE 2,10 : PRINT NAMES
LOCATE 3,10 : PRINT "Address"
LOCATE 4,10 : PRINT "Zip"
LOCATE 5,10 : PRINT "City"
LOCATE 3,30 : INPUT ADDRESS$
LOCATE 4,30 : INPUT ZIP CODE
LOCATE 5,30 : INPUT CITY$
END FUNCTION

```

```

IDENTIFICATION DIVISION.
PROGRAM-ID.
    POPADDR.
AUTHOR.
    JOHN.
DATE-WRITTEN.
    JULY 15, 1992.
DATA DIVISION.
WORKING STORAGE S
    01 NAME
PROCEDURE DIVISION
A000 - SAY NAME
    DISPLAY NAME
    ACCEPT
    STOP

```



# Odyssee lets you avoid the punishment of programming development.



*Creating applications doesn't have to hurt*

The extraordinarily complex process of writing software applications is time-consuming and repetitive. And can get you into a lot of trouble.

If after months of writing in excess of thousands of lines of code a client decides to change the specs or platform, the punishing procedure begins all over again.

Introducing Odyssee from Case Design, a new concept in programming development soft-



*Odyssee is innovative, flexible and portable*

ware that eliminates the need for editors or a high degree of technical skill. Odyssee is a fully integrated tool that features DBMS support, WYSIWYG user interface design and reporting.

In the development cycle, you can access a wide variety of helpful features including a data dictionary, physical and logical independence, tasks, actions, events and expressions. Resulting applications can run on a variety of OS platforms



*Call for a free demo disk and try it yourself*

(DOS, WINDOWS, UNIX) with no charge.

Creating the data structure and manipulating the database are features of Odyssee that are transparent to the developers. Odyssee can simultaneously access and simplify the use of many different DBMS, including XBASE, ORACLE, UNIFY, SYBASE and DB RAIMA.

Call Case Design to learn how truly edifying Odyssee can be.

## ODYSSEE FEATURES & CAPABILITIES

- No code or editors needed.
- Totally menu-driven.
- Object-orientation.
- Hypertext technology included.
- Data and process independence.
- Powerful built-in data manipulation.
- No run-time fees.

## FREE INTRODUCTORY OFFER

Purchase Odyssee now and you'll receive a free introductory offer valued at \$400.

## THE ODYSSEE STARTER KIT — \$1299

MS-DOS, XBASE for single user. Other platforms available. Call today for more details.

## 30-DAY MONEY-BACK GUARANTEE



**CASE DESIGN**  
RESULTS ORIENTED

**CALL 1-800-880-1100**

9111 Jollyville Road • Suite 207 • Austin, Texas 78759  
Phone (512) 346-8991 • Fax (512) 346-7920

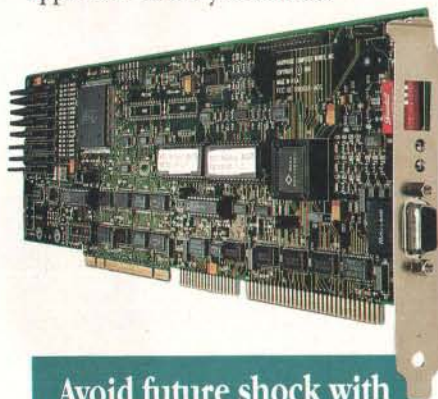
Ad Code B1



# Hauppauge announces an en

## Modular Local Bus PC's from Hauppauge Computer Works

**Bust the bottleneck.** Hauppauge introduces its 486M series: Modular, LocalBus PC's designed for tomorrow's Windows applications ...yet affordable today. The 486M PC's bust the 8-MHz I/O bottleneck by using a local bus with a direct connection from the Intel 486 CPU chip to the graphics processor. There's also up to 1 MByte of CPU cache RAM and lots of system memory (from 4MB to 64MBytes). Features you can afford today. Features you'll appreciate in the years ahead.



### Avoid future shock with Hauppauge CPU modules

**Full throttle graphics.** Designed by our engineers and built here in the U.S.A., our 486M PC's are for Windows users who need more performance at an affordable price. And for users who have seen the dizzying change in technology and don't want to buy a new computer every two years. We know you don't want to replace your computer every time a new trend develops.

**Fly non-stop.** New generations of CPU's and software are being intro-

duced at a rapid pace. Hauppauge's LocalBus PC's are designed to be upgraded in three ways: CPU upgrade, Module upgrade and Module addition:

### The Modular LocalBus improves PC performance

**CPU upgrade.** Hauppauge 486M PC's are designed to accept any 486 CPU chip. Simply remove the old 486 from its LIF socket and replace it with a newer, faster CPU and you're off and running with the latest 486 processor power.

**Module upgrade.** As new generations of CPU chips come to market, CPU upgrade will not always be possible. The Hauppauge LocalBus is designed as a 64-bit bus to allow upgrades to future CPU generations with maximum performance.



**Module addition.** Wondering what future software might require of your hardware? Our 486M PC's have a LocalBus slot for hardware accelerators that can solve long-term software problems.

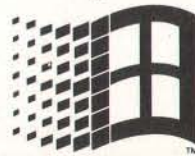
# Local

**Local bus graphics.** For the absolute highest in Windows graphics performance, we've put our GUIacc

(Graphical User Interface accelerator) right on the LocalBus. It includes the S3 graphics accelerator plus 1MByte of high speed Video RAM and a HiColor DAC. The GUIacc runs at the CPU speed, giving you the highest performance graphics combination available anywhere! Run your favorite true-color paint or drawing program with super performance.

### All Hauppauge PC's include:

- Microsoft DOS 5.0
- Microsoft Windows 3.1
- Norton Desktop for Windows 2.0
- Factory installed, ready to run software on hard disk with floppy disk backups
- 30-day satisfaction guarantee
- One year warranty
- Unlimited technical support



MICROSOFT  
WINDOWS<sup>™</sup>  
COMPATIBLE



THE NORTON  
DESKTOP  
FOR WINDOWS



# to the Windows graphics jam:

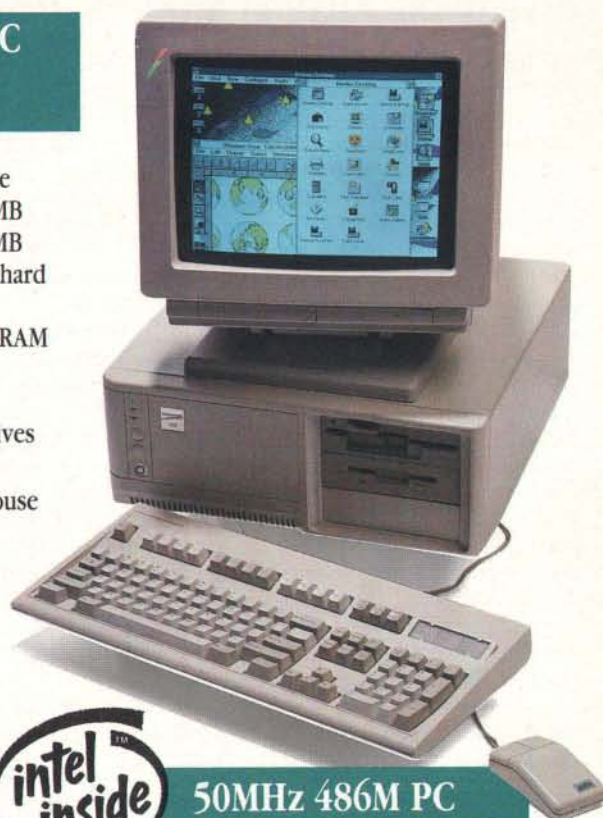
## Bus!!

### 33MHz 486M PC \$2595

Intel 486DX-33 CPU module  
128K cache, expandable to 1MB  
4MB RAM, expandable to 64MB  
130MB <16msec cached IDE hard  
disk drive  
Local bus GULacc with 1MB VRAM  
and Hi-color DAC  
14" Super VGA monitor  
1.2MB, 1.44MB floppy disk drives  
2 serial, 1 parallel  
Maxiswitch 101 keyboard, mouse

### 66 MHz 486M PC \$2995

Intel 486DX2-66 CPU module  
128K cache, expandable to 1MB  
4MB RAM, expandable to 64MB  
130MB <16msec cached IDE hard  
disk drive  
Local bus GULacc with 1MB VRAM  
and Hi-color DAC  
14" Super VGA monitor  
1.2MB, 1.44MB floppy disk drives  
2 serial, 1 parallel  
Maxiswitch 101 keyboard, mouse



### 50MHz 486M PC \$2895

Full speed Intel 486DX-50 CPU  
128K cache, expandable to 1MB  
4MB RAM, expandable to 64MB  
130MB <16msec cached IDE hard  
disk drive  
Local bus GULacc with 1MB VRAM  
and Hi-color DAC  
14" Super VGA monitor  
1.2MB, 1.44MB floppy disk drives  
2 serial, 1 parallel  
Maxiswitch 101 keyboard, mouse

### 4860 CADstation

Our dual processor 4860 CADstation is designed for specific, heavy-duty AutoCAD applications. We've packed it with both a 33MHz 486 processor for fast overall performance and an Intel i860 RISC accelerator to speed up AutoCAD and Autosshade. And you'll get our 1152x900 24-bit per pixel local bus frame buffer for photo-realistic drawings. Dual monitor support plus the Hauppauge GULacc top

off feature list to make the 4860 CADstation the world's best PC for CAD!

Hauppauge's specially designed ADI/860 driver takes advantage of the i860 graphics capability for the best performance CAD system available. The ADI/860 is compatible with:

- AutoCAD rel. 11 and rel. 12
- Autosshade ver 2
- 3D-Studio version 1 and 2

Prices start at \$6995.

## Hauppauge!

#### Hauppauge Direct

91 Cabot Court, Hauppauge, NY 11788

**800-443-6284**

In NY: 516-434-1600 FAX 516-434-3198

Germany: Hauppauge Comp. Works, Europe

Tel: 02161-17063

Adlon Datenverarbeitung, Ravensburg

Tel: 0751-76070

UK: Hauppauge Comp. Works, London

Tel: 071-378-7309

Denmark: SC Metric A/S, Naerum

Tel: 42-804200

Circle 110 on Inquiry Card.



## Cyrix Wins Against Intel; the Mostek Ghost

**A** federal judge has ruled that SGS-Thomson has the right to make, use, and sell processors incorporating intellectual property of Intel, including but not limited to FasMath coprocessors that SGS-Thomson is producing for chip maker Cyrix. If the decision of U.S. District Judge Paul Brown in Sherman, Texas, is upheld, it could have implications in a similar suit between Intel and Cyrix regarding the production of Cyrix's 486-compatible processors, which SGS-Thomson is also producing.

The Intel/SGS-Thomson suit, filed in January in the federal district court, started out as a dispute between Cyrix and Intel over the alleged infringement by Cyrix's math coprocessor of an Intel patent. Although Cyrix designed the coprocessor, SGS-Thomson actually produced the chip.

Part of Cyrix's defense (Cyrix's primary defense is that its products do not infringe Intel patents) in the case against Intel was that SGS-Thomson manufactured the coprocessor under a license from Intel. When Intel disputed SGS-Thomson's rights under the license agreement, SGS-Thomson intervened in the lawsuit. SGS-Thomson contended it had the right to make the processor because it had inherited the rights to a cross-licensing agree-

ment signed in 1977 between Intel and Mostek. (In 1980, Mostek was sold to United Technologies and was later resold in 1985 to Thomson Components.)

Judge Brown ruled that because SGS-Thomson is the successor to the rights of Mostek, the manufacture and sale by SGS-Thomson of products under the 1977 agreement exhausts the patent rights of Intel. It's ironic that Mostek is brought back into semiconductor industry news via the legal path.

As in the mid-1980s, when Mostek suffered heavily due to the influx of competition from Japanese chip makers, the company again symbolizes the state of an industry. Mostek is now but a minimal part of SGS-Thomson's overall operations—even the Mostek name was removed from company letterhead a few months after its 1985 acquisition.

SGS-Thomson erased the name, but it still held Mostek's cross-licensing agreements. It now appears that Mostek's legal documents, particularly the ones it signed with Intel, were the company's most important assets for SGS-Thomson: Legal suits and countersuits in the semiconductor industry are sadly as important to a chip company's survival as they are to its ability to innovate.

—David Andrews

## U.K. Study: VDUs Safe for Pregnant Women

**L**ONDON—A study funded by the U.K.'s Health and Safety Executive into the dangers of VDUs (Video Display Units) for pregnant women concludes that women who use a VDU during pregnancy are no more likely to have a miscarriage than those that don't use one. The results, which are based on data gathered from 450 women, found no correlation between computer usage and the likelihood of a miscarriage. The report concludes, "For

many women who use VDUs in their jobs, this finding provides reassurance."

The study was conducted at the Medical Research Council's Epidemiology Monitoring unit at the London School of Hygiene and Tropical Medicine. The study, entitled "Spontaneous abortion and work with VDUs," was written by Eve Roman, Valerie Beral, Margo Pelerin, and Carol Herman.

—Andy Redfern

## Codec Adds Support for QuickTime CD-ROM Feature Films

**B**OSTON—Apple has licensed SuperMac Technology's Compact Video codec technology to allow 2 hours worth of QuickTime movies to be stored on a CD. SuperMac said that the codec can compress QuickTime movies playing in up to a 320- by 240-pixel video window at a full-motion 30 fps. Adding the codec to the

QuickTime scheme should be rather simple once Apple chugs out the appropriate code to users: You can select the compression method that QuickTime uses from a dialog box. Apple now has a way to deliver feature-length films on CD-ROM for use on a QuickTime-equipped Mac.

—Larry Loeb

## NANOBYTES

**Quorum Software Systems** (Menlo Park, CA) has resolved the lawsuit it filed against **Apple** on May 11. Quorum filed suit after Apple asserted that Quorum had violated Apple's intellectual property. Apple then revoked Quorum's Certified Developer status. Terms of the settlement were not disclosed, but Quorum's Apple developer status will be restored. With the lawsuit out of the way, Quorum can develop and sell its products without fear of legal action from Apple. □

Maybe one day **AT&T** will sue the world. The company has through Unix Systems Laboratories extended a lawsuit against **Berkeley Software Design, Inc.** (Falls Church, VA) to include the regents of the University of California, including Governor Pete Wilson. USL seeks to permanently enjoin the regents and BSDI from developing, promoting, reproducing, and distributing computer software products that USL says is based on, copied from, or derived from proprietary Unix operating-system software, except as authorized by agreements between the regents and USL or AT&T. AT&T claims that in contravention of these license agreements, the regents have permitted the Computer Sciences Research Group of the University of California to widely distribute to persons who are not authorized licensees of USL, computer operating-system software known as Networking release 2. Developers in the Unix community respond that they have been asking AT&T for years if the company claims any rights to the Networking release 2 software and AT&T refused to answer.

According to one developer, AT&T's claim of a conspiracy to release the AT&T software is "outrageous, considering that there were people at U Cal that were trying their damndest to avoid this type of thing." Stay tuned. □



**NOW JUST \$495!**  
(Suggested retail price)

# What Comes After Spreadsheets?

## Introducing New CA-Compete!

Up to 12 different dimensions you can navigate through with the click of a mouse.

Use simple English—no column or row references needed.

Name and save multiple views. Look at up to 12 at a time.

Extra sheets available for custom reports and additional calculations.

CA-Compete! - BUSPLAN1.MDL

File Edit Formulas Format Options Tools Window Help

GLOBAL =Sales-Total Cost

Product Actuals - 1989

	East	Actual	
Units	19,499	34,678	23,597
Price	\$0.75	\$1.40	\$1.05
Sales	\$14,624	\$48,549	\$24,777
COGS	\$13,671	\$24,314	\$16,544
SG&A	\$1,462	\$4,855	\$2,478
Total Cost	\$15,134	\$29,168	\$19,022
Profits	(\$509)	\$19,381	\$5,755

Eastern Forecast - Pdt A

	East	Plan	
% Sales	1989	1990	1991
Sales	100.00%	100.00%	100.00%
COGS	81.57%	79.63%	77.77%
SG&A	12.00%	12.00%	12.00%
Total Cost	93.57%	91.63%	89.77%
Profits	6.43%	8.37%	10.23%
Tax	2.70%	3.52%	4.30%
Net Income	3.73%	4.86%	5.93%

Variance Report

Variance Report by Product

Eastern Region -- 1989

	Actual	Plan	Variance
LPs			
Units	19,499	21,344	(1,845)
Price	\$0.75	\$0.75	\$0.00
Sales	\$14,624	\$16,008	(\$1,384)
Cost of Goods Sold	\$13,671	\$13,058	\$613
Selling & Admin.	\$1,462	\$1,921	(\$459)
Total Cost	\$15,134	\$14,979	\$155
Profits	(\$509)	\$1,029	(\$1,539)
CDs			
Units	34,678	30,200	4,478
Price	\$1.40	\$1.40	\$0.00
Sales	\$48,549	\$42,280	\$6,269
Cost of Goods Sold	\$24,314	\$18,476	\$5,838
Selling & Admin.	\$4,855	\$5,074	(\$219)
Total Cost	\$29,168	\$23,549	\$5,619
Profits	\$19,381	\$18,731	\$650
Tapes			
Units	23,597	26,100	(2,503)

Global formulas you can apply to a range of cells.

Presentation-quality output with fonts, borders, and shades.

Looks like a spreadsheet with standard commands you know, like cut, paste, copy, and annotate.

Chosen "Best of 1990" by PC Magazine.\*

Welcome to the world of multi-dimensional modeling & viewing.

Unlike two-dimensional spreadsheets, CA-Compete! lets you model up to 12 different dimensions and navigate between them

**Tools**

- Allocate...
- Curve Builder...
- Forecast...
- Audit Trail...
- Goal Seek...
- Data Table...

instantly with the click of a mouse. And CA-Compete!™ speaks English too, so you can use recognizable names you define, like Sales, Units, Costs and Profit

instead of cryptic column and row references. For smarter

Audit (Product Actuals - 1989)

Cell	Formula
SALES	=SUM(Sales!A1:A10)
COGS	=SUM(Costs!A1:A10)
SG&A	=SUM(SG&A!A1:A10)
TOTAL COST	=SUM(COGS!A1:A10)+SUM(SG&A!A1:A10)
PROFITS	=SUM(Sales!A1:A10)-SUM(TOTAL COST!A1:A10)

decision-making there's a broad range of powerful tools like Goal Seek, Allocate, and Forecast, so you can perform extensive "what-is" and "what-if" analyses.

You can also trace the origin of any value with a quick, graphical Audit Trail Tool.

CA-Compete! reads and writes Lotus® 1-2-3®, Excel®, dBase®, ASCII and

Goal Seek

Target Cell: LPs Profits: 1989 Actual East

Initial Value: (\$509)

Current Value: (\$509)

Goal Value: 1900

Source Cell to be Modified: Price

Cell Value: 10.75

OK Cancel Auto Options...



Script Files so you can work with all of your current files.



And with Windows' Dynamic Data Exchange, you can link your data dynamically with any other Windows program.

Call 1-800-CALL CAI today to get a CA-Compete! Working Model.

It's your chance to get a free glimpse of the future.



**COMPUTER ASSOCIATES**  
Software superior by design.



# "FEATURES, COMFORT, POWER, AND

**Actually, we'd say impossible to beat. And so will you.**

Just compare Express notebooks to the competition — the way leading computer publications have been doing. And you'll see that we have the most features at the lowest prices.

You'll see why *Computer Shopper* (8/92) said the Express 325NXL was "...destined to be the power accessory of the future." Why *Computer Buying World* (8/92) praised its "small, light, attractive and reasonably priced package." Why *PC Magazine* (8/92) said the 325NXL is the notebook made for "those looking for a good value at the \$2,000 price point."

And why there should be no question which notebook computer to buy.

*"... will help you get your work done comfortably at the right price."*

*PC Magazine, August 1992*

These are the notebooks you've been waiting for — whether you need a 25MHz 386SX like our 325NXL or a 25MHz 486 like our 425CXL. As *Computer Buying World* said, "CompuAdd Express' 325NXL has most of the extras every notebook should have." So does the 425CXL. And they've got performance, too. *PC Magazine* gave the 325NXL high marks on video and graphics benchmarks and on battery life tests — "the third-highest score of the 70 systems tested."

Our super-twist backlit liquid crystal display has 64 levels of gray scale and a .30mm dot pitch. It measures 9.4" diagonally.

We install a 9600 baud fax/2400 baud modem, both with send/receive capabilities. And we include Quick Link II fax/modem software **FREE**.

Brightness and other display controls are on the keyboard surface.

Most notebook microprocessors run at only 16MHz or 20MHz. Ours run at 25MHz. 425CXL contains Cyrix CX486SLC; 325NXL contains AMD 386SX.

Sleep button and built-in power management logic for up to 3 hours battery life on the 425CXL; 3 to 4 hours on the 325NXL.

High density 1.44MB 3.5" internal floppy drive.

Two click buttons work with the trackball to select icons and commands.

True notebook size (8.5"x11"x2")

## See For Yourself. Express Has The Most Features

	Express 325NXL	Dell 325N	Compudyne 386SXL/25	Gateway 325SXL	Austin 386SX/25	PC Brand 386SX/25
MSDOS/WIN	Yes	Yes	Yes	Yes	No	Yes
HD SIZE	80	60	60	80	60	60
WT w/ADAPTER	6.6 LBS	7.6LBS	7.6LBS	7.1LBS	8.7LBS	8.8LBS
RAM	4MB	4MB	2MB	2MB	1MB	2MB
FAX/MODEM	Yes	Option	Option	Option	Option	Option
GRAY SCALE	64	32	64	64	32	32
ZDIGIT RUNDN	5hr 28min	5hr 12min	3hr 26min	5hr 41min	4hr 48min	2hr 45min
BLT N TKBALL	Yes	No	Yes	No	No	No
PRICE	\$2,095	\$2,698	\$1,806	\$2,095	\$2,293	\$1,944

Based on *PC Magazine* Survey. August 1992

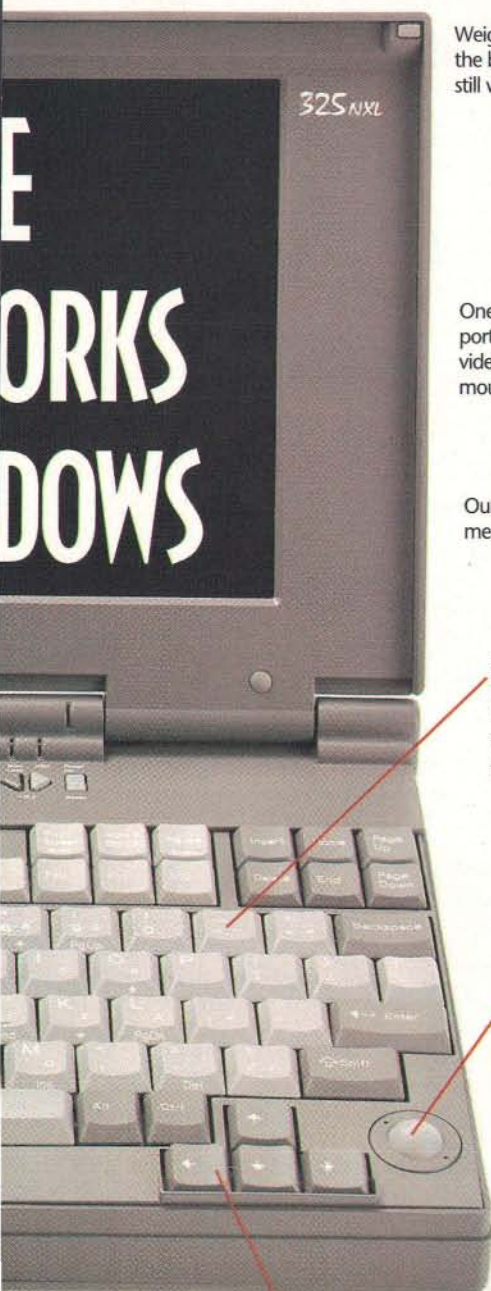
*"The clear winner... with its terrific balance of performance and extras."*

*Computer Buying World,  
August 1992*



# PRICE — REALLY TOUGH TO BEAT."

*Computer Shopper, August 1992*



Weighs only 5.3 pounds, even including the battery. Add the AC adapter, and it still weighs only 6.6 pounds.

425CXL includes a math coprocessor; 325NXL contains socket for Cyrix FasMath™ 83587 math coprocessor

One serial port, one parallel port. External 800x600 VGA video, PS/2 keyboard and PS/2 mouse connectors.

Our 80MB hard drive and 4MB of RAM mean big Windows programs run great.

101-key function keyboard implemented with 84-key layout has an IBM "feel" because it's made by Lexmark, formerly IBM's keyboard division. Fullsize function keys, too!

Built-in trackball with 200dpi for accurate pointing.

Our **FREE** carrying case has a shoulder strap and pockets. Pack adapters, diskettes and other supplies.

Inverted "T" arrow keys are in the lower right hand corner, where they belong.



**FREE** LotusWorks integrated business software pre-loaded.

**FREE** AC wall adapter

**FREE** Windows 3.1 and MS DOS 5.0



**Express 325NXL** Everybody loves our notebooks' features. *Computer Shopper* wrote that "The built-in 2,400bps fax/modem is snazzy" and called the keyboard, sliding door covering ports and general design "an admirable piece of work." *PC Magazine* wrote: "The Lexmark keyboard is comfortable to use. Large and prominent function keys are ranged along the top, and the cursor keys are in an inverted-T layout just left of the trackball." *Computer Buying World* also praised the keyboard, which it said "is remarkably well laid out."

~~\$2,095~~  
**\$1,995**

Lease for only ~~\$13~~ /mo

**Express 425CXL** The 425CXL has all the terrific features that made its 386 partner so popular. But it has extra speed, thanks to its Cyrix CX486SLC microprocessor. This processor is smaller than other 486 chips, so it fits easily into a portable computer. It uses less power than other 486 chips, so you're less likely to run out of juice in the middle of a big job. Yet it has a built-in cache. And the 425CXL contains a math coprocessor, so applications that use floating point instructions are swift indeed.

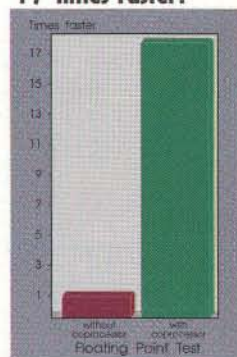
~~WAS \$2,595~~

**\$2,395**

Lease for only ~~\$88~~ /mo

The 425CXL has a built-in math coprocessor. You can add one to your 325NXL. So programs that use floating point instructions run 17 times faster than an equivalent system without a coprocessor. Test: PC Tech FFT.

**17 Times Faster!**



**CompuAdd**  
*Express*

**TO ORDER, OR FOR INFORMATION ON OUR FULL LINE OF DESKTOP SYSTEMS, CALL**

**800-925-3525** 351

12306 Technology Boulevard, Austin, Texas 78727  
Hours 8am-6pm (CST) M-F 512-219-1800 Fax 512-219-2890

We accept MasterCard, VISA, CompuAdd Express Charge, money orders, certified checks (please allow ten days for processing), CODs, company and institutional purchase orders (minimum initial purchase \$250, thereafter \$50 with approved credit) and wire transfers. Shipping charges are calculated according to weight and distance. Texas residents, please add appropriate local sales tax. CompuAdd Express will replace or repair defective hardware, software and consumable items. A 15 percent restocking fee may be charged. All return items must be accompanied by a return merchandise authorization (RMA) number. CompuAdd Express sells and services equipment within the United States only and will pay no customs, duties or tariffs on returned merchandise. Prices and product descriptions are subject to change without notice. CompuAdd Express is not liable for damage due to omissions or typographical errors. A copy of our limited warranty is available prior to sale from your sales representative.

**Circle 86 on Inquiry Card.**



## IBM May Spin Off Personal Systems Division

**A**t press time, sources said that IBM was expected to announce the reorganization of its Personal Systems LOB (line of business) into at least one subsidiary wholly owned by Big Blue. Most likely headed by current Personal Systems LOB president James Cannavino, such a company would include desktop systems ranging from the low-end PS/1 to the high-end RISC System/6000 workstations. While the spun-off company would probably take along AIX development, sources have reported that OS/2 may stay behind—perhaps in a subsidiary all its own.

Rumors of the decision circulated for months amid news of IBM competitors' price reductions and product introductions. While IBM sources revealed only that IBM has been considering many options to make the Personal Systems LOB more efficient, other sources close to IBM confirmed that the spin-off had been delayed since mid-summer.

One reason why IBM may spin off OS/2 in a different direction, said sources, is that many IBM executives believe the option to preinstall Microsoft Windows on selected PS/2 models may boost sales in certain channels. At press time, while OS/2 was preinstalled only on PS/2 Models 57SLC and 56SLC, loyalty toward the operating system has understandably kept IBM from preinstalling Windows on PS/2s. "The OS/2-Windows connection has been muddying the waters for too

long," said one contact.

Analysts note that recent IBM PC price reductions were made only after several other major PC vendors had announced price cuts. And the new line of low-end PCs IBM was expected to announce in September is months behind similar product offerings by Dell, Tandy, Compaq, and several other vendors.

It is exactly this kind of sluggish response to rapidly changing market conditions that IBM executives are seeking to eliminate. What remains to be seen is how much more lithe and efficient the Personal Systems division would be if it were to gain more autonomy, either as a wholly owned subsidiary or as an independent company such as Lexmark. Despite IBM chairman John Akers' best efforts to decentralize operations, the many levels of IBM management continue to prevent the Personal Systems business from reacting quickly to its competition.

Whichever option it chooses, IBM hopes the result will be a company that can swim faster in this fluid market than Cannavino's LOB so far has shown. "A \$9 billion company is still going to have a tougher time bringing out a product than a \$750 million company," said Cliff Friedman, an analyst for the New York firm Bear Stearns. "But [the Personal Systems spin-off] will help. If structured properly, it will make them a more competitive company."

—Ed Perratore

## European Portable Workstation Project Launched

**L**ONDON—The ESPRIT (European Strategic Programme for Research in Information Technology) has appointed Cambridge-based computer manufacturer Acorn to head its latest project. The POWER (Portable Workstation for Education in Europe) project is set to run for three years and is charged with building a portable computer with speech input and wireless networking specially suited for education and training needs. The machine will be based around Advanced RISC Machines' RAM processor—the device at the heart of Apple's Newton.

Although details of the final machine's specification are sketchy, the CPU will obviously be an ARM processor. Other ARM chips are likely to be developed especially for system power saving. OPSIS, a French optoelectronic component de-

signer, has a small, low-power LCD that it probably can scale up for use as the system screen. Pluricom, a Portuguese wireless networking specialist, will provide the networking facilities, especially in the area of wireless communications.

The Belgium-based speech-recognition and compression company Lernout & Hauspie probably will contribute voice input, control, and memo-taking facilities. Although Acorn has its own operating system for the ARM processor called RISC-OS, the inclusion of Italian firm Etnoteam in the project points to a joint development of system software. Portugal's University of Aveiro is also a partner. Although ARM has yet to set a detailed timetable, the project will unlikely create any tangible results in the first 18 months. ■

—Andy Redfern

## NANOBYTES

Financial management software can be useful in helping you organize your personal business affairs, but the problem is that you often have to spend time at the keyboard performing the tedious task of entering data from credit-card statements every month. To help solve that problem, **Intuit** (Menlo Park, CA, (415) 322-0573) is working on a program that is designed to slash data-entry time by means of a new Intelli-Charge Credit Card tracking feature. The new tracking feature automatically enters credit-card charges via floppy disk or downloaded by modem into the Quick-En register. The first credit card that will support the new service is Visa. □

The latest word from **Next Computer** is that it plans to release **NextStep 486**, the port of the workstation company's system software to the Intel platform, late in the fourth quarter of this year and possibly in early 1993. A spokesperson for Next Computer said that the company should begin beta testing of NextStep 486 sometime in October or November. □

At press time, **IBM** was putting the finishing touches on its big push into the commercial Unix arena, an expansion of the RISC System/6000 workstations' original marketing thrust toward the scientific and research community. In addition to announcing new high-end models in its workstation and server line, IBM was expected to announce at the September Unix Expo in New York new on-line transaction-processing software designed for commercial AIX applications, such as banking, ATMs (automatic teller machines), and reservations. This new Unix software fulfills IBM's January 1991 announcement that it will support the Open Software Foundation's DCE (Distributed Computing Environment). ■



# The Quality Memory Solution

# Phar Lap DOS-Extenders



## When your reputation's at stake...

We know how much work you put into building your product. Why use inferior tools that often create more problems than they solve? With a Phar Lap DOS-Extender, you know you're getting industry-leading, market-tested tools that have worked reliably for thousands of developers. Other DOS extenders simply can't measure up. Let Phar Lap show you what a DOS extender should be.

**Phar Lap Software: Chosen 10 to 1 over all other DOS extenders. Here's why:**

	Phar Lap DOS-Extender	Vendor A	Vendor B
<b>Maturity</b>	Over 5 years and 1000 applications	Less than a year	Brand new
<b>Memory Model</b>	Safe	Dangerous	Dangerous
<b>Compatibility</b>	INT 15, XMS, VCPI, DPMI	XMS, DPMI	XMS, VCPI
<b>Library Support</b>	Extensive list of 32-bit libraries	Limited library support	Limited library support
<b>Documentation</b>	Extensive and detailed	Limited	Less than 50 pages

**640K  
DOS  
Barrier**

**Shatter the 640K barrier and build multi-megabyte DOS applications.**

**Overlay  
Linkers**

**No more suffering with overlays or EMS.**

**Unsafe  
Memory  
Models**

**Other DOS extenders can let common programming errors cause system crashes.**

## Build multi-megabyte DOS programs with Phar Lap's DOS-Extenders!

**286|DOS-Extender™ — it's never been so easy!** With our 286|DOS-Extender and your Microsoft C/C++, Borland C++ or Microsoft Fortran compiler, you've got all the tools you'll need to quickly and easily build multi-megabyte protected-mode applications — often by simply relinking without making source code changes. Now you can build protected mode applications that access up to 16 megabytes of memory on any DOS-based 80286, 386, 386SX, or i486 PC — without changing development tools! 286|DOS-Extender is also compatible with both Borland's Turbo Debugger and Microsoft's linker and CodeView debugger.

**386|DOS-Extender™ — the ultimate in 32-bit power.** 386|DOS-Extender turns DOS into a true 32-bit operating system with a flat, 32-bit address space. Your program can access all the memory available in the machine — up to 4 gigabytes! 386|DOS-Extender runs on any DOS-based 80386, 386SX, or i486 PC, and has been used in over 800 applications, including AutoCAD 386 and IBM's Interleaf Publisher. It is backed by a full complement of 32-bit languages, including C, C++, Fortran, Pascal, Ada and Assembler. With true 32-bit performance, you can finally build workstation-class applications for the PC.



Trademark holders: 286|DOS-Extender™, 386|DOS-Extender™ - Phar Lap Software, Inc.; Interleaf Publisher™ - Interleaf, Inc.; Windows™ - Microsoft Corp.; DESQview™ - Quarterdeck Office Systems. Registered trademark holders: Phar Lap™ - Phar Lap Software, Inc.; AutoCAD® - Autodesk, Inc.; Borland® - Borland International, Inc.; IBM® - IBM Corporation; CodeView®, Microsoft®, MS-DOS® - Microsoft Corp.



Phar Lap Software, Inc.  
60 Aberdeen Avenue  
Cambridge, MA 02138  
617-661-1510  
FAX 617-876-2972





# The Official Flag Of The

## AMD Delivers The World's Fastest 386s.

The great 386 race is over. And the clear winner is the Am386 microprocessor family.

The fact is, no other 386 microprocessors available today can rival the sheer speed and performance of the Am386 microprocessors. The Am386DXL-40 CPU brings 40MHz,



*The 40MHz DXL-40 and the 33MHz SXL-33 are available in low-cost POFP packaging.*



full 32-bit 386 performance to the desktop. The Am386SXL-33 CPU makes 33MHz the standard for 386SX machines both at the desktop and for battery powered applications.

In either case, they're over 20% faster than those run-of-the-mill 386s.





# Am386 Microprocessors.

And of course, they're proven-compatible with the IBM® standard.

Best of all, they're available now, available in quantity, and available at surprisingly low prices.

So don't just keep up with the competition with ordinary 386 systems. Blow them away with the world's fastest 386 systems—built around the Am386 microprocessors from Advanced

Micro Devices. Call **1-800-222-9323** for more information.



**Advanced Micro Devices**

*"We're Not Your Competition."™*

Is a trademark of Advanced Micro Devices, Inc. All brand or product names mentioned are trademarks or registered trademarks of their respective holders.

**Circle 67 on Inquiry Card.**



# CORELDRAW 3.0

## THE FIRST ALL-IN-ONE GRAPHICS SOFTWARE

In the information-packed '90s, good graphics are more important than ever to get your message across quickly and effectively. And now it's easier than ever to use graphics — with CorelDRAW 3.0! Everything you need is in one value-packed box. There is no longer any need to buy separate illustration, charting, painting, and presentation

packages. CorelDRAW 3.0 does it all with unmatched power and ease-of-use! And, as an unprecedented bonus, Corel has included a CD-ROM with over 14,000 clipart images and over 250 fonts! You'll get fingertip convenience for software that would otherwise occupy over 500 floppy disks and cost thousands of dollars.

### Outstanding Reviews!

*"CorelDRAW remains the easiest-to-use graphics product on the market...the ultimate graphics bargain!"*

PC Magazine, August, 1992

*"CorelDRAW — ALL THAT MOST PEOPLE WILL EVER WANT in the way of a graphics software..."*

William D. Harrel, Windows Magazine, July, 1992

*"Business users who need a wide variety of graphics functions shouldn't pass up this package. It is an amazing bargain."*

Luisa Simone, PC Magazine, August, 1992

*"CorelDRAW 3.0 is without doubt the most powerful, feature-laden, and best value for money graphics systems for Windows, at any price point. Full stop, end of discussion."*

Jon Honeyball, Windows Magazine UK, August, 1992

*"Endowed with paint, chart and presentation capabilities, this upgrade of the leading PC draw package is a stunning example of increased power at a reduced price."*

Christina Wood, PC WORLD, July, 1992

*"It's hard to find a more value-laden offering. We rate the value as excellent."*

Mike Heck, INFOWORLD, July 13, 1992

*"Total relative value of CorelDRAW modules, clipart and fonts is \$15,000."*

John Butler, Seybold Report on Desktop Publishing, July, 1992

*"CorelDRAW is a phenomenal bargain"*

Michael Burgard, PC/Computing, July, 1992

Suggested retail price  
**\$595**

### Outstanding Value!

Other companies need several packages to do what Corel does in one!

Company	Drawing/ Illustration	Charting/ Presentation	Photo- Editing	Fonts	Clipart	Total Cost
Micrografx	Designer	Charisma	Picture Publisher	251	3940	\$1685
Software Publishing Corporation	Harvard Draw	Harvard Graphics: (Windows)	Not Available	62	1600	\$1190
Aldus	Freehand	Persuasion	PhotoStyler	12	305	\$1885
Corel	CorelDRAW!	CorelDRAW!	CorelDRAW!	256	14,000	<b>\$595</b>

No wonder CorelDRAW is the world's best selling graphics software for Windows!



# CORELDRAW!

## 1-800-836-DRAW

**CORELDRAW WORLD DESIGN CONTEST**

Enter now and win valuable prizes in the monthly contests (from Sept. '92 to April '93). Each monthly winner qualifies as a finalist in the Annual Design Contest in May '93.

Come see us at:  
**COMDEX/FALL '92**  
LVCC, BOOTH #1116  
Nov. 16-20th, 1992

**FREE 24 hour Technical Support**

CorelDRAW is **MULTIPLATFORM** for corporate standardization: Windows, OS/2, UNIX. And soon available on the MAC, and in 20 languages!

Call now for a free demo-disk and brochure!



# IN THE LAND OF THE DOUBLE BYTE

**T**OKYO—No matter where you happen to be in the world, political reporters all look the same. Not long ago, for example, Japan's Prime Minister Miyazawa was giving a speech in a building down the street from my office on Tokyo's Nami-ki Avenue. When the PM's press corps came bounding out of vans to follow their man, it occurred to me that they were look-alikes of the American "boys on the bus" who followed George Bush and Bill Clinton last fall. They had the same blue blazers and wrinkled khakis, the same nondescript ties worn loosened at the neck, and the same look of wry cynicism as they whipped out their miniature tape recorders to record the familiar phrases one more time.

Still, there was something missing from this picture, and it took me a while to put my finger on it. The computers! Unlike their counterparts in the U.S., Europe, and elsewhere, not a single one of the Japanese reporters was equipped with a personal computer to file a story. I later asked my friend Koizumi-san, a technology correspondent for Japan's biggest daily newspaper, why he and his colleagues didn't use laptop computers. "Computers—they're much too slow," he said. "It takes so long to enter a sentence! It's just faster to write your story out in longhand and call it in to the paper by dictation."

Of course, no speaker of English or any other Western language could say that. Any halfway-decent two-finger typist can produce text faster on a keyboard than by writing in longhand, and sending text via modem from a computer is infinitely faster than dictating. But Japan's written language is so unbelievably complex that, even today, the basic chore of entering text into a machine remains a relatively cumbersome job. A great deal of ingenuity has been devoted to making this task easier, and Japanese computer companies have done some remarkable things in this area. But the very nature of the language still poses a formidable barrier to writing.

Once you understand the difficulty of dealing with written Japanese, you can begin to understand some of the basic differences in computing on the two sides of the Pacific. It is largely the language difference that explains why Japan has been so far ahead of the U.S. in the quality of its graphical displays (and thus in video-game technology). It is also largely the language difference that explains why the Japanese, for all their technological smarts, have yet to make a dent in the software industry. And the language difference is the main reason that so many successful American software houses have de-

clined—despite the urging of no less a crusader than Microsoft CEO Bill Gates—to move into the fast-growing Japanese market.

Japan's written language is a testament to the cultural adaptability of the nation, with elements from the Roman, Arabic, Chinese, and indigenous Japanese alphabets all freely mixed in together. The result is a writing system that employs not just 26 letters, or 260, or even 2600, but rather 6000 or more separate symbols.

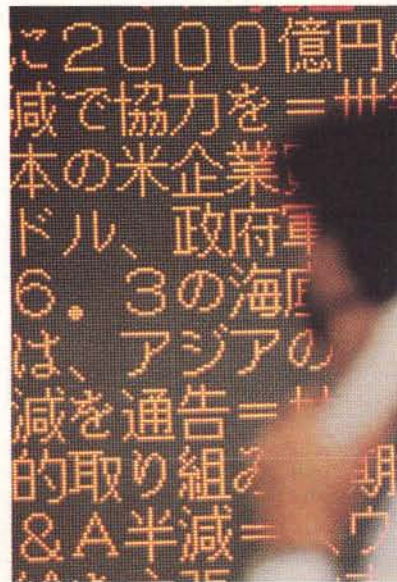
In addition to the 26 Roman letters, the Japanese have two different alphabets of their own, each with 47 kana, or letters. On top of that, Japanese writing employs the same ideographic characters used in China; basic literacy requires about 2000 of these kanji characters, and better-educated folks employ 6000 of them or so.

Since each of the kanji is an individual word with its own meaning and pronunciation, the only way to learn to read Japanese is to memorize these characters, one by one. The education authorities have developed a highly systematic methodology to ensure that every student masters all 1941 "daily-use kanji" by the end of high school.

Teaching computers how to handle such a complex system has proved even tougher. On the display side, for example, standard Western methods of character display are simply inadequate for the task. In the West, the ASCII standard permits up to 256 distinct symbols in a single 8-bit byte; that's more than enough to support 26 lowercase letters, 26 uppercase letters, and a full complement of punctuation and diacritical marks. But it's not nearly enough for Japanese writing.

Initially, Japanese computers used the ASCII character set, forcing the Japanese to do all their computing in English. That is one of the reasons why personal

**The Japanese are overcoming the kanji hurdle. So why aren't American software vendors jumping in?**





computers were slower to develop in Japan than elsewhere. Eventually, the Japanese developed their own coding system that employs two 8-bit bytes; this "double-byte code," or DBC, permits up to 65,000 individual symbols, each encoded using Japan's version of ASCII, the JIS (Japanese Industrial Standard) code.

Since kanji tend to be more complex graphically than Roman letters—a single character can have as many as 25 different strokes—they are harder to replicate with pixels on a screen. It was this need that prompted Japan's computer makers to develop sharper display standards than the ones used by American firms early in the computer revolution, and the Japanese have stayed ahead ever since. The enhanced display power of Japanese equipment also made it possible for Japanese video and computer-game companies to develop much more elaborate graphics than their American counterparts.

But it's one thing to handle kanji in memory or on a display screen; it's something else entirely to design a keyboard that can be used to input literally thousands of distinct characters. Some early Japanese computers did have kanji keyboards—great banked contraptions with row upon row of input keys—that looked something like a Wurlitzer organ on steroids. These devices proved cumbersome to build and all but impossible to use. Clearly a different approach was required.

The big Japanese computer firms responded with a rather elegant solution: automatic kanji conversion. Today, Japanese computers all use a fairly standard QWERTY keyboard, sometimes with just one more row of keys than a Western computer keyboard has. On this keyboard, the writer types a Japanese word phonetically, using either Roman letters or the Japanese phonetic symbols, the kana. The computer then displays on the screen each of the kanji or kanji combinations representing the sound that was typed. The writer picks the kanji character he or she had in mind, and that character is included in the text.

For example, say that you type the word *kanji*. This word has at least six different meanings in Japanese. In addition to "Chinese character," *kanji* can also mean "feeling," "secretary," "supervisor," a particular kind of smile, or an ancient historical era. Each meaning is represented by a distinct combination of kanji characters.

When you push the keyboard's Convert key, the computer automatically displays on the screen each of the six words that are pronounced "kahn-jee." You then enter a number to choose the one you want, and that word is added to your sentence. Since kanji conversion is a two-step process,

it is obviously slower than straight typing. That's why reporters like my friend Koizumi-san find computers too slow for writing their stories, at least on deadline.

Because Japan's language is full of homonyms, kanji conversion is a rigorous software challenge. I recently saw a demonstration of the VP-2100, Fujitsu's mighty supercomputer, which had been programmed to translate from Japanese to English. Just to be nasty, somebody asked

**T**oday, conversion programs are strong at judging from context which kanji you have in mind.

it to translate the sentence "Kisha no kisha wa kisha de kisha shita." Each *kisha* in that sentence is a different word. It actually took the computer longer to decide which kanji combinations to use for each *kisha* than it took to produce the English translation: "The reporter from your company returned to the office on the train."

But Japanese electronics companies have made enormous strides in making their kanji-conversion software faster and smarter. The showplace for this conversion software is a Japanese breed of machine known as a Wah-Puro. (The name is an abbreviation of the phrase "wah-doe purosessah," the Japanese pronunciation of "word processor.") A Wah-Puro is a cross between a typewriter and a laptop computer, with surprisingly high-powered printing and formatting capabilities built in. About a dozen makers produce scores of different Wah-Puro models, and one of the chief areas of competition is the speed and sophistication of the automatic kanji conversion.

Today, automatic conversion programs are surprisingly strong at judging from context which kanji you are likely to have in mind when you type in a particular phonetic combination. My 4-pound, \$450 Sharp Wah-Puro guesses correctly about 80 percent of the time. I can now type a complete sentence in phonetic Japanese using the standard QWERTY keyboard of my Wah-Puro, press the Conversion key,

and watch this ingenious machine reproduce my sentence in kanji and kana.

In fact, automatic conversion programs, both on Wah-Puro and personal computers, are so powerful now that there's a backlash against them in the Japanese education establishment. The argument is familiar to anybody who's seen American teachers railing against the use of calculators in math class. Just like the American kids who don't bother learning the multiplication table because they can always get the answer from a calculator, there are evidently some Japanese kids who don't bother learning their kanji. Hey, if all I have to do is type in the word in Roman letters and my Wah-Puro will find the right kanji for me, why should I spend all those hours learning how to write these complicated 25-stroke characters?

Despite the achievements of the Japanese Wah-Puro and personal computer makers in dealing with the inherent problems of their labyrinthine language, the kanji factor stands as a significant subconscious barrier that has kept many successful American software houses out of the lucrative Japanese market, the second-biggest PC market in the world.

There's no question that American software can compete in Japan. Virtually every Japanese PC is built around a microprocessor from the Intel 80x86 family. MS-DOS (most commonly in a Japanese version called DOS-V) is the most common operating system. As of this writing, the best-selling application program in Japan is Lotus 1-2-3; the fastest-growing software is Microsoft Windows, and its popularity obviously opens the door for many more U.S. software programs.

But countless American software firms have stayed away. This is a matter of considerable frustration for the most important figure in software, Microsoft's Gates. "I'm crusading to get people into the Japanese market," he said on a trip to Tokyo a few years back. "I have talked to hundreds of software companies about this. These are guys who are writing some very sophisticated code, but they say, 'I don't know how to write in double-byte, so I can't deal with kanji.' And I say to them, 'Look, there are standard algorithms for this. There are established methods for writing to double-byte. Kanji make things more complicated, but you can make computers handle those complications. Look, the Japanese do it every day.' " ■

*T. R. Reid is Tokyo bureau chief for the Washington Post and author of a syndicated personal computer column. You can reach him on BIX c/o "editors" or on CompuServe at 76703,726.*



# BEFORE YOU BUY A PRINT SERVER, GET UP TO SPEED ON OURS.



Take a look at this comparison chart. Then

you'll see why Castelle network printer servers, the JetPress and LANpress, are quickly becoming so popular.

The JetPress and LANpress are both designed for a Novell NetWare environment. The JetPress fits inside an HP LaserJet printer. The LANpress is self-contained and supports up to four printers via serial and parallel ports.

But when it comes to the competition, both print servers have a lot in common. They both outperform the Intel NetPort. And they offer superior network capabilities. Including

▲ Feature	Castelle JetPress™	Castelle LANpress®	Intel NetPort
▲ Speed*	48 seconds	60 seconds	160 seconds
▲ File servers supported	8	8	1
▲ Print queues supported	32	32	8
▲ Ports	1	4	2
▲ Encrypted password support	yes	yes	no
▲ On-the-fly configuration and status reporting	yes	yes	no
▲ Suggested retail price	\$595**	\$695***	\$695

(\*Time to transfer a one-page graphics file from the print queue to an HP LaserJet III printer; \*\*Ethernet version; \*\*\*Ethernet 3+1 version)

encrypted password support, automatic and forced ECONFIG, preferred server designation, SPX protocol for on-the-fly status reporting, as well as automatic reconnect after the file server is down.

Castelle print servers are GSA listed, backed by a 30-day money back guarantee, and support both Ethernet and Token Ring networks.

In other words, you get more of everything. For less than you'd pay for the competitor.

For product literature, details on the money back guarantee, and the name of the Castelle dealer nearest you, call 1-800-359-7654. Because the sooner you get up to speed, the quicker you'll want to buy Castelle.

## CASTELLE

Enhancing your network productivity.



# Compudyne™. Latest Technology. Highest

**C**ompudyne is the PC manufacturing and direct marketing arm of CompUSA,™ the Computer SuperStore (NASDAQ symbol: CUSA)—inventors of big volume, deep discounting PC retailing, and the largest chain of computer super stores in the country. Compudyne manufactures top quality, fully-supported computers as available from only the largest PC manufacturers at prices typically found only at garage shop clone houses.

Result? We're already one of the largest direct PC companies in the country and guarantee that our prices are the lowest of any currently advertised!



We are to PC prices what  
"The Rhapsody for Subsonic Tubas" was to music.  
Some notes were so low, no one could hear them.  
Requests for an encore were even lower.



Compudyne is probably the fastest growing PC company in the history of the industry.



We are to notebooks what Griselda of Skyland was to Pomeranians; the lightest.

## Notebooks

Feast your eyes on "one of the best notebook values around" (Mobile Office 7/92), snugly packed into a slim, trim, 5.5 lb package (including battery).

- 11" x 8.5" x 1.6" (yes, only 1.6" thick!)
- Full 10", 64 grayscale brilliant VGA screen

- Internal 3 1/2" 1.44 MB floppy drive
- Built-in trackball saves carrying a mouse
- Microsoft® Windows 3.1 installed ready to run
- Polaris PackRat 4.0™ Personal Information Manager™
- External SVGA monitor and keyboard support

- Toshiba-compatible external expansion bus
- User-installable FAX modem and other options
- Full keyboard—dedicated 'page up/down', 'home' and 'end' keys
- Built-in serial (2) and parallel (1) ports
- FCC Class B certification



Notebook	CPU	RAM (MBs)	HD (MBs)	Battery Life (hrs)	Price
386SXL/25	386SXL-25 MHz, Optional 80387SX	2 standard, 4 & 6 options	60	3+	<b>\$1,599</b> \$59/mo*
386SL/25	Intel 80386SL-25 MHz, 64 K CPU cache Advanced SL power management, Optional 80387SX co-processor	as above	80	3+	<b>\$1,899</b> \$70/mo*
486SX/25	Intel 80486SX-25 MHz, Built-in 8K CPU cache	4 standard, 8 & 20 options	80	2.5+	<b>\$2,199</b> \$81/mo*
486DX/33	Intel 80486DX-33 MHz, Built-in 8K CPU cache	as above	130	2.5+	<b>\$2,999</b> \$111/mo*

## ORDERING

- ▶ 1-800-932-COMP (2667)
- ▶ International callers dial:  
1-214-702-0055
- ▶ 24 hour fax: 1-214-702-0300
- ▶ Corporate credit and volume terms available.



## HOURS OF OPERATION

- ▶ 8am-7pm (CST) Mon.-Fri. and  
9am-5pm (CST) Sat.

## WARRANTIES

- ▶ 30-day, no questions asked,  
return policy.√
- ▶ 1 year limited warranty.

## SERVICE & SUPPORT

- ▶ Toll-free technical support
- ▶ On-site service for desktops†† and  
overnight replacement for portables.
- ▶ Next-day shipping for most systems.

†† Within 100 miles of any Dow Jones Service Center. \*\*Does not include Windows 3.1 or mouse. √ Must be returned "as new" in original packaging.



# Quality. Lowest Prices. Guaranteed.

## Desktops

Order one of our pre-configured systems or custom-configure your own, choosing from a myriad of options. All systems include...

- Microsoft® Windows 3.1 installed ready to run
- Microsoft compatible serial mouse
- 200 watt power supply
- 101 AT-style keyboards
- FCC Class B certification

- Built in serial (2), parallel (1) and game (1) ports
- Artisoft's LANtastic® LAN
- 8 i/o board slots
- U/L listing



## Get Horizontal...

Our standard desktop systems feature aesthetic, yet rugged, plastic over steel construction, with

"one screw" assembly for quick, easy upgrades. They support 3 externally accessible 5.25" drive bays and 2 internal 3.5" units.

## Get Vertical...

For those who prefer the aesthetics and footprint of a desktop tower or need the added drive capacity for file server applications, our mini tower offers an astonishing 6 drive capacity; 4 external plus 1 internal 5.25" and 1 internal 3.5" unit in a mere 8"x16" footprint, for only \$75 more.

## Options, Options, Options...

- Displays: Mono or color VGA; 1024 and 1280 interlaced or non-interlaced; 14" to 20"
- Hard Drives: 40; 80; 105; 120; 211; 483; 680 MBs or 1.2 GBs
- Internal CD-ROM (Inc. Groliers Encyclopedia, Toolworks, Reference Library and PC-SIG)
- Internal FAX/Modem: 9600 bps send/receive fax; 2400 bps modem; inc. WinFax and Quicklink Software.
- And many more!

**PRICE Guarantee**



If you can find a PC that meets or exceeds our equivalent specification, but is shipping at a lower advertised price, we'll match the price.



4/14/92  
LANtastic  
ver 4.1



LANtastic  
in all systems!



Desktop	CPU	RAM (MBs)	HD (MBs)	Floppy	Display	Price
386SX/25	Intel 80386SX-25 MHz	1 standard 32 max	50	1.2 or 1.44	16 bit SVGA card, 14" 640x480 VGA Color Monitor	<b>\$899**</b> \$33/mo*
386DX/33	Intel 80386DX-33 MHz	2 standard 32 max	80	as above	as above	<b>\$999</b> \$37/mo*
486SX/25	Intel 80486SX-25 MHz Built-in 8K CPU cache	as above	105	1.2 & 1.44	16 bit SVGA card, 14" 1024x768 SVGA Color Monitor	<b>\$1,299</b> \$48/mo*
386DX/33 CACHE	Intel 80386DX-33 MHz 64K CPU cache	4 standard 32 max	105	as above	16 bit SVGA card, w/ 1MB video RAM & Hi-Color Support, 14" 1024x768 SVGA Non-Interlaced Multisync, Color Monitor	<b>\$1,499</b> \$56/mo*
486DX/33 CACHE	Intel 80486DX-33 MHz 128K CPU cache	4 standard 64 max	130	as above	as above	<b>\$1,799</b> \$67/mo*
486DX2/50 CACHE	Intel 80486DX2-50 MHz, 128K CPU cache New Double Clock CPU	as above	130	as above	as above	<b>\$1,999</b> \$74/mo*
486DX/50 CACHE	Intel 80486DX-50 MHz 128K CPU cache, True 50 MHz CPU	8 standard 64 max	210	as above	as above	<b>\$2,499</b> \$89/mo*
486DX2/66 CACHE	Intel 80486DX2-66 MHz, 128K CPU cache New Double Clock CPU	as above	210	as above	as above	<b>\$2,999</b> \$111/mo*



**COMPU DYNE**

THE LOWEST OF THE LOW PRICES. GUARANTEED.

Prices and specifications subject to change without notice. CompuDyne Direct, 15151 A Surveyor, Addison TX 75244.

BTE1021

Intel™ 386 & 486 & the Intel Inside logo are trademarks of Intel Corp. ®/® Trademarks belong to their registered owners. \*Leasing arranged through Leasing Group, Inc; payments based on 36 month open-end rate.

Circle 216 on Inquiry Card.

You can also buy these neat products at the same prices exclusively at

**COMPU SA**





# Apple's Performas: Macs for the Home

TOM THOMPSON AND TOM R. HALFHILL

## Apple changes its marketing strategy to reach first-time buyers via mass marketing

notebook line (see the text box "The PowerBook 145" on page 53).

Mass-market channels are so important to Apple's strategy because the Performas are targeted at a challenging subset of the consumer market: first-time buyers. Out of 95 million U.S. households, Apple has identified 7 million that can afford a Performa but have never owned a home computer. Apple's ambitious goal is to con-

In 1985, Apple chairman and CEO John Sculley declared that Apple sold "computers for use in the home, not home computers." That ambiguous position has now changed—sort of. Apple is selling its new Macintosh Performa line of home computers through mass-market channels nationwide. In other news, Apple ratcheted up the processing power in its midrange

vince those holdouts that the time is ripe to not only buy a computer, but to buy a Mac.

Of course, the question of what exactly is a home computer has bedeviled manufacturers for years. Apple's answer is that a home computer is a fully functional Mac that's slightly repackaged and sold just about anywhere but a computer store. According to Apple's market research, novices are afraid of computer stores. Thus, the Performas are appearing at 1600 mass-market outlets, such as Sears, Silo, Office Depot, and Office Max. For now, though, Apple won't sell the systems at discount stores or warehouse clubs.

The Mac Performa line comprises three machines: the low-end Performa 200, the midrange Performa 400, and the high-end Performa 600. Two of these systems aren't new: The Performa 200 and 400 are actually the Mac Classic II and LC II, respectively. Except for new names, the only differences between the computers are minor revisions to System 7.0 and some bundled software.

The top-end Performa 600, which at press time was scheduled to ship in late October, is the only genuinely new model in the lineup. It has the same dimensions as a Mac IIci, but with important differences. It's also priced at about \$2500, which is much higher than the \$1000 barrier sometimes regarded as the upper limit for a true mass-market consumer product.

### The Performa 600

Because the Performa 200 and 400 are hardware-identical to the popular Classic II and LC II, we'll focus on the Performa 600 and contrast it to the Mac IIci where applicable. The Performa's 68030 processor is clocked at 31.33 MHz (versus the IIci's 25 MHz) on a 32-bit bus. While the 68882 FPU is standard equipment on the Mac IIci, there's only a socket for it on the Performa 600. The Performa 600 will come with 4 MB of RAM soldered to the main logic board, and it's expandable to 68 MB using 16-MB SIMMs in four sockets.

It has the usual three NuBus slots (not a NuBus 90 implementation, as in the Mac Quadras) and an *accelerator slot*, which is different from the IIci's cache slot. Also present is a 160-MB hard drive, 8-bit sound I/O with a microphone, and the usual complement of external SCSI, LocalTalk, serial, and ADB (Apple Desktop Bus) ports.

Typical of a computer targeted for the home, the Performa 600 doesn't have a



*The Mac Performa 600 is the only genuinely new model in the Performa line.*



built-in Ethernet port. There's a big 5½-inch half-height bay at the front of the computer, where you can add an optional CD-ROM drive or an extra high-capacity hard drive. Like the Ilci, the Performa has built-in video, but it's improved in two ways.

First, the Performa's video frame buffer lives in 512 KB of VRAM (video RAM), while the Ilci's buffer resides in a bank of main memory. The Performa's VRAM eliminates the bus-contention performance hit that occurs on the Ilci when the processor and video circuitry vie for the same chunk of memory. Second, the Performa's VRAM is expandable to 1 MB (by swapping the two 256-KB SIMMs for 512-KB SIMMs). This provides 16-bit-deep images (displaying 32,768 colors) on 640-by-480-pixel resolution monitors, versus only the 8-bit-deep image (256 colors) available on the Ilci's video.

The Performa 600 comes in two configurations. The base model has 4 MB of RAM and 512 KB of VRAM. The "multimedia" version has 5 MB of RAM and 1 MB of VRAM. It fills the 5½-inch bay with Apple's new CD-300i CD-ROM drive. Apple's CD-300i doubles the rpm when reading data to achieve a high transfer rate of 300 KBps, but slows down to normal speeds when playing audio discs. The CD-300i can also read multisession Kodak Photo CDs, and Apple provides software to view these images. The 16-bit color depth enables the display to accurately reproduce the Photo CD images.

Since the advent of the Mac LC and Ilci, sound input has become the standard for all Macs, and the Performas are no exception. Disappointingly, the Performa 600 uses an upgraded version of the Mac LC's sound ASIC (application-specific IC) for recording and generation, rather than the more full-featured Enhanced Apple Digital Sound Chip found in the Mac Quadras and PowerBooks. Thus, the Performa 600 has no stereo output, except for an audio pass-through to the sound jack for the CD-ROM drive. The computer's 8-bit monaural audio can, however, be mixed during output with the stereo audio CD sound.

The Performa 600's accelerator slot is nearly identical to the Mac Ilci's cache slot, but it lacks the cache control lines. Therefore, the Performa requires intelligent cards that have their own microprocessor, controller, and memory. Apple believes that most 68040 accelerator cards for the Mac Ilci should work with little or

## The PowerBook 145

**W**hen Apple introduced the PowerBook line, it provided three systems to match users' varying needs. At the low end is the PowerBook 100, with a 16-MHz 68000 processor and a super-twist LCD screen. The PowerBook 140 occupies the midrange with a 16-MHz 68030 processor and a super-twist LCD screen. Covering the high end is the PowerBook 170, with a 25-MHz 68030 processor, a 68882 FPU, and a razor-sharp active-matrix screen.

Sales were split almost evenly among the three computers, with two-thirds of the buyers opting for the more powerful 68030-based notebooks. Mac users obviously demand desktop performance out of their PowerBooks.

To accommodate this demand, Apple is beefing up its midrange computer line by introducing the PowerBook 145. Essentially, it has the heart of the PowerBook 170 (a 25-MHz 68030) but the face of a PowerBook 140 (a super-twist LCD screen). Apple decided not to pump up the price along with the power: A system with 4 MB of RAM and a 40-MB hard drive costs \$2399. By contrast, a similarly equipped PowerBook 140 costs \$2999, while a PowerBook 170 with the same RAM and storage costs \$4299. The PowerBook 145 thus moves the midrange notebook line to 25-MHz performance levels while reducing the price. Not surprisingly, with the PowerBook 145's winning price/performance combination, Apple has retired the PowerBook 140.

no modification in the Performa 600.

Performa buyers will be offered two new 14-inch monitors instead of Apple's current 12-inch RGB color monitor, a 512-by-384-pixel oddball that causes problems for some color applications that expect a 640-by-480-pixel screen. One of the new monitors, known simply as the Performa Display, is a low-end replacement for the 12-inch monitor; it supports 256 colors at 640 by 480 pixels with a 0.39-mm dot pitch. The higher-end Performa Plus Display supports 32,000 colors at 640 by 480 pixels with a 0.29-mm dot pitch. It also emits less ELF/VLF radiation, conforming to the SWEDAC MPR-2 standard.

With the Performa line, Apple is departing from its practice of announcing suggested retail prices. The street prices will probably range from about \$1250 for the Performa 200 to \$2500 for the CD-equipped Performa 600. The 14-inch monitors will probably cost \$350 to \$450.

### Get the Works

A key element in Apple's bid to attract novice buyers is bundled software. All Performas come with a special version of System 7.0 and some application programs preinstalled on the hard disk. The idea is to

provide a complete plug-and-play package while minimizing the number of decisions that buyers must make at the critical moment of purchase.

The Performa-specific system software offers a friendlier substitute for the Finder and a simplified application launcher. Performa users see a new Desktop with colored patterns when they boot up the computer. The Finder is actually hidden behind this customizable backdrop. A new window labeled "Application Launcher" contains several buttons resembling icons. These buttons launch applications with a single click.

One of the buttons, Apple Backup, is a utility for backing up the hard disk onto floppy disks. Another button launches At Ease, a new security program intended to make it safer to share the computer with other users, especially children. (See the text box "Child-Proofing Your Mac" on page 54.) For more advanced file management, the regular Finder is still accessible from a menu.

The bundled applications vary according to deals between Apple and the chain stores. Apple says this lets retailers customize their bundles. Some chains may bundle programs not found on Performas



# Child-Proofing Your Mac

One way to justify the high price of a home computer is to share it among the family. Unfortunately, this reasoning breaks down when your children are at that age where dragging documents into the Trashcan and emptying it just to see the sides of the Trashcan icon bulge and straighten fascinates them. You'll be fascinated, too, when you discover what happened to several hours of work you left on the Mac.

To solve this problem—and consequently get a Mac Performa under your roof—Apple software engineers crafted a new interface shell called At Ease, which requires System 7.0. Whereas the Finder (itself an interface shell) allows you unrestricted access to most of the Mac, At Ease's goal is to limit access to critical files while not hampering ease of use. At Ease does this by consolidating selected applications into an Applications "folder" and a Documents "folder." Those files not selected when you configure At Ease simply don't appear.

Buttons represent applications or doc-



At Ease restricts access to the computer while providing a friendly interface. Note the lack of the Mac Desktop and Trashcan icons.

uments, and a single mouse-click launches the application or opens the document (see the screen). If you have more than one screen's worth of applications or documents, a dog-ear with an arrow appears on the corner to let you click on and switch to the next screen of icons. When you save a file, it appears as a new button in the Documents folder. The software has a setting that forces you to save your file to a floppy

disk, useful when you don't want numerous users swamping the Mac's hard disk with files, such as in a classroom.

At Ease lets you run several applications at once, and you can easily switch between them. However, no amount of clicking gets you to the traditional Mac Desktop to view the hard disk and tamper with its files. Nor is there a Trashcan icon present, so you have no ready way to delete files. The Control Panels folder doesn't appear in the Apple menu, so you can't alter important system settings, either. The File menu has a selection that lets you switch into the Finder, but you can block this access to others with a password.

At Ease is composed of the shell application and a Control Panel, which you use to configure how At Ease operates. You can set whether At Ease or the Finder launches when the computer starts up, designate what applications appear in the Applications folder, set the Finder access password, select the floppy disk for storage, and designate which new documents appear as buttons in the Documents folder.

sold at competing stores, and this will influence street prices. However, all Performas are expected to have a Works-style package that includes a word processor, a spreadsheet, a telecommunications program, a paint program, and a flat-file database. The CD-ROM version of the Performa 600 will come bundled with several CD titles.

## Apple on a Limb

Apple's newfound determination to sell Macs to the masses is a long-overdue strategy. We're thankful that Apple made no attempt to cripple the Performas, as IBM did in 1983 with the PCjr. But it's surprising that Apple made so little effort to differentiate the Performas from regular

Macs, to the point of merely renaming two of the three computers in the lineup. And the prices, by consumer standards, are stratospheric.

Apple hopes that software like At Ease will help justify the cost by promoting the sharing of the computer in the household. Can Apple succeed where others have either failed or feared to tread? ■

*Tom Thompson is a BYTE senior technical editor at large and an expert on the Macintosh. You can contact him on BIX as "tom\_thompson" or on AppleLink as "T.THOMPSON." Tom R. Halfhill is BYTE's senior news editor in San Francisco. You can contact him on BIX as "thalfhill."*

## THE FACTS

### Mac Performa 200, 400, 600

(no suggested retail prices)

### Mac PowerBook 145

with 4 MB of RAM and a 40-MB hard drive, \$2399;  
with 4 MB of RAM and an 80-MB hard drive, \$2799

Apple Computer, Inc.  
20525 Mariani Ave.  
Cupertino, CA 95014  
(408) 996-1010  
fax: (408) 974-6412

Circle 1059 on Inquiry Card.



# The Evolution of CAD

From the beginning of time, we have tried to express ourselves through graphics.

In the beginning of time people had to use primitive design tools for creating any type of graphics.



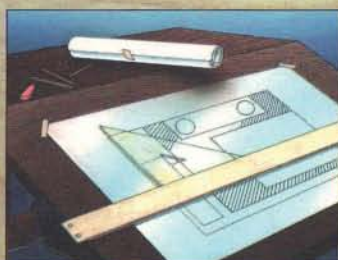
In the 15th Century design tools were quill ink pens and crude styles of paper.



300 to 400% less \$ than AutoCAD!

Faster and easier to use than AutoCAD!

By the 18th Century we had advanced to the drafting table with T-squares, and the dreaded eraser.



In the 20th Century the first CAD programs were very slow and extremely difficult to use, not to mention the expense of buying them.



Now step into the 21st Century...

## DesignCAD

NEW

### Professional Version

PC MAGAZINE  
EDITORS' CHOICE  
December 17, 1991  
DesignCAD 2-D, Ver. 5.0



PC MAGAZINE  
EDITORS' CHOICE  
December 11, 1990  
DesignCAD 3-D, Ver. 3.1



DesignCAD Professional is the only complete CAD solution. It's 6 packages in one!

- **DesignCAD 2D** has all the tools and power necessary to produce professional architectural or mechanical blueprints. With DesignCAD 2D you will become extremely productive!
- **DesignCAD 3D** gives you the power to create and manipulate solid or wireframe objects with quick and easy commands. Render your designs with outstanding photorealistic color!
- **Video Training Tapes** for DesignCAD Professional, are produced in a state-of-the-art facility using award winning writers, and professional technicians. Using these video tapes will assure you of learning faster with higher retention, while becoming more productive!
- **SmartEST** quickly generates a spread sheet from your DesignCAD drawings so you may estimate cost, and do take-offs for accurate bidding.
- **Symbol Libraries** contain over 6700 pre-drawn Architectural and industry standard symbols. These alone will save you a tremendous amount of time and money!
- **ScanPRO** converts (Raster to Vector), scanned images into files that can be read by DesignCAD or most other CAD programs.  
**Circle 71 on Inquiry Card.**  
Call, fax or write for a **FREE** brochure & demo!



American  
Small Business Computers

One American Way  
Pryor, OK 74361

ph: (918) 825-4844 fax: (918) 825-6359



# It's perfect for executives

The Librex R386SL is an easy decision for even the most indecisive. Because it's so adaptable,

you can change it as quickly as you change your mind. **A** You can easily upgrade the

standard screen (*32 shades of grey*) to VGA color with just a snap. (*Makes even the duller data*

*look interesting.*) **B** It offers a removable 80 or 120MB hard disk drive, so you can build a library

of files and keep data secure. (*More storage than the biggest of file cabinets.*) **C** The inte-

grated track-ball mouse can be easily snapped over for left-hand use. (*Sort of like equal rights*

*for southpaws.*) **D** And you can replace the floppy drive with the auxiliary "extra-life"

battery pack to increase operating time from three to up to eight continuous hours. (*Which*

*means you won't have to watch those lousy in-flight movies ever again.*) **E** For more info,

or to find out how to get a \$100 credit for Librex options, call 1-800-248-4880, Dept. R1.

Battery life:  
Up to 8 hours with  
auxiliary "extra-life" battery.

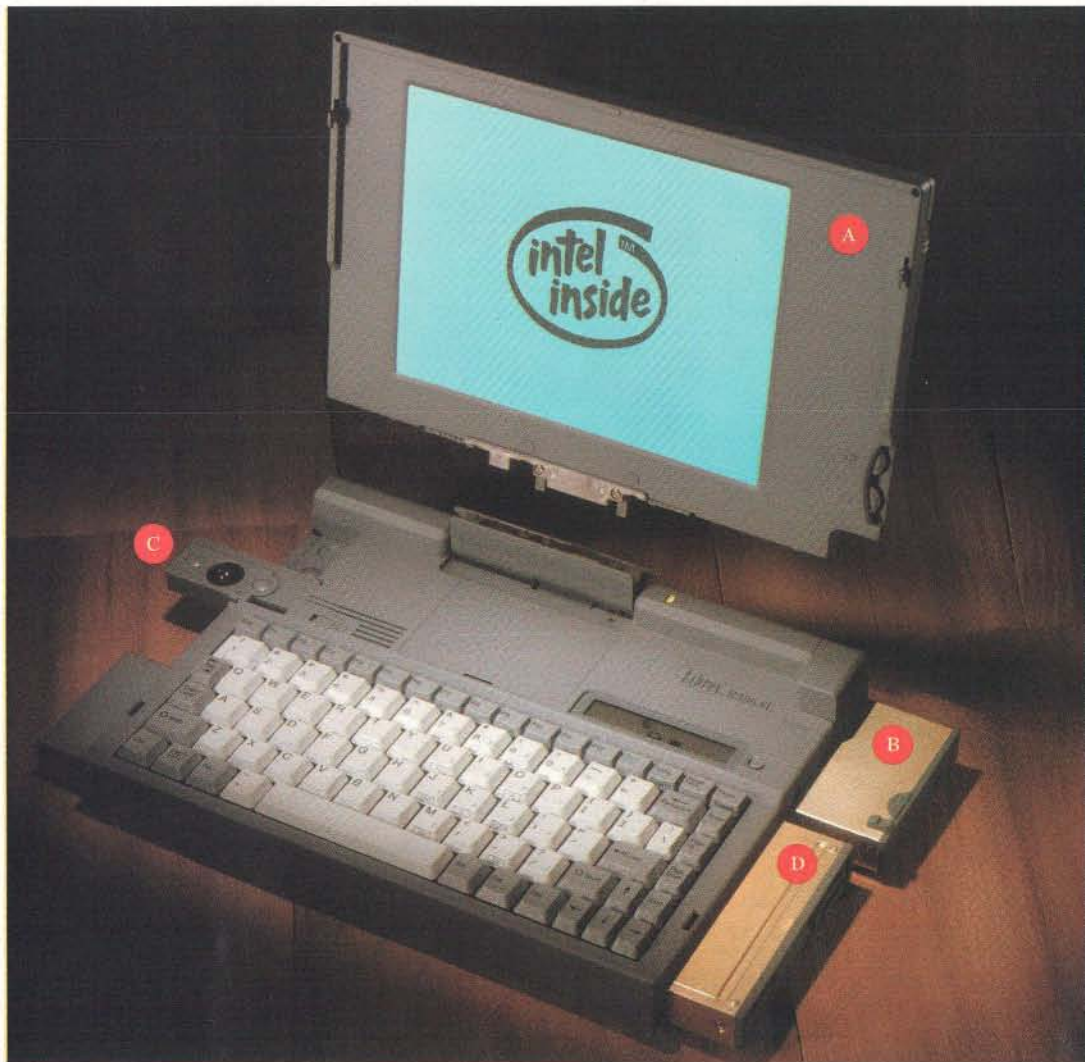
Display:  
9.5" Monochrome LCD.  
Upgradeable to color.

Size/weight:  
8.5" x 11.6" x 1.9"  
6.5 lbs with one battery.

CPU:  
i386SL, 25MHz



who can't make decisions.



For illustration only. Computer must be fully assembled to operate. © 1992 Librex Computer Systems, Inc. Other company and product names are trademarks or registered trademarks of their respective holders.

Memory: 4-20 MB.  
Storage: 80 or 120 MB  
removable hard drive.

Integrated mouse:  
Detachable for right and  
left-hand users.

Options:  
Internal Fax/Modem.

**Librex**™

The Freedom Of One.

E

Circle 123 on Inquiry Card.



## An Almost-Perfect Printer/Plotter

**M**y first thought as I took the ProTracer out of its shipping carton was, "Here is something of quality." The packaging was detailed with paper tabs protecting hard-to-see points of contact on the case. Strips of tape, each tabbed on one end for easy removal, held everything in place inside a hermetically sealed, water-proof plastic bag, probably good to 50 fathoms.

I was not surprised, therefore, to find an impeccably designed printer. The ProTracer is flawlessly executed, with every line meeting exactly where it should with uncommon elegance and precision. Without a blemish inside or out, the ProTracer's appearance alone indicates that this is a product that is well worth its price.

The ProTracer printer/plotter is based on a Canon ink-jet engine and prints on any stock up to 17 inches wide. It has a versatile paper path, accepting manually fed single sheets from the front and continuous perforated stock from the back. For even greater flexibility, you can install optional automatic sheet-cut feeders for 8½ by 11-inch (A size) through 17- by 22-inch (C size) stock.

The printer includes emulation modes for the Epson LQ-1050 and IBM Proprinter XL24E. Optional plug-in cards—each about the size of a credit card—allow HP 7585 HPGL (Hewlett-Packard Graphics Language) and PostScript emulation. Although these options are modestly priced, both of them require that you install additional (optional) memory as well.

Interfacing the ProTracer is easy. You can use a standard Centronics-type parallel port, a serial port, or both. Using both lets two computers share the printer without the hassle of a switch box. It's a neat, useful concept, especially in small, congested offices. In single computer installations, you can use the parallel port for normal printing. You then set your CAD system to use the parallel port for printing and set the serial port for plotting, a configuration that is a major convenience when switching paper sizes or modes of printing.

The disk supplied with the ProTracer includes a printer setup and control pro-



gram and ADI (Autodesk Device Interface) drivers for AutoCAD. The setup program provides complete control of the printer in a well-structured, Windows-like environment, essentially making the printer control panel redundant. I ended up using the setup program more often than the printer buttons.

The plotter throughput is where the ProTracer really shines, trouncing both laser printers and full-size plotters in speed. To compare performance, I printed a floor plan that completely filled an 8½ by 11-inch page. It took 4 minutes, 34 seconds using my Panasonic KX-P4450 laser printer, but only 1 minute, 44 seconds using the ProTracer and the optional HPGL emulation card. (I should note here that my HPGL card was an engineering prototype; according to Pacific Data Products, the production models will be substantially faster.)

The ProTracer loses the race with standard text, however. It took me 1 minute, 13 seconds to print a full single-spaced page, compared with only 20 seconds when I printed it on the laser printer using unidirectional printing.

For applications where plotting on large-format stock is important, the ProTracer is exceptionally attractive. Full-featured plotters, such as the HP DraftPro, are priced at \$3500 and up, about \$1000 more than a fully equipped ProTracer. And they are much slower, generally taking 30 minutes or more to plot a C-size drawing compared to about 5 minutes with the ProTracer. The only fly in the ointment is that

the ProTracer can't do colors...not yet, at any rate. But then, neither does my laser printer.

The target audience for this product is obviously engineering, drafting, and architectural offices. Pacific Data Products, with its typical conservative candor, suggests that the ProTracer is useful for "draft"-quality plots. In fact, the output is quite satisfactory for any monochrome (i.e., black) engineering or architectural drawing. Sure, if you look closely you'll find very minor blemishes, but you'll see the same thing with regular pen plotters as well.

After using the ProTracer for just a short while, I'm quite willing to suffer with the acceptable print/plot quality, pocket the major difference in price, and enjoy the huge increase in performance over a standard plotter. HP and other plotter manufacturers are going to weep over the ProTracer, mark my words.

Pacific Data Products has produced a beautifully crafted, economical, and exceptionally versatile printer/plotter. It's ideally suited as a personal plotter in a technical environment, offering a unique combination of features that allows easy setup and exceptionally versatile output. And to sweeten the pot even more, the ProTracer not only comes with a 60-day return privilege, it also includes a one-year warranty with replacement parts shipped overnight.

—James M. Hansen

### THE FACTS

#### ProTracer

\$1499

memory-expansion card: 2 MB,

\$299; 4 MB, \$499; 8 MB, \$899

HPGL emulation card, \$399

PostScript emulation card, \$499

Pacific Data Products, Inc.

9125 Rehco Rd.

San Diego, CA 92121

(619) 552-0880

fax: (619) 552-0889

**Circle 1054 on Inquiry Card.**



# THE WORLD'S FIRST OPTICAL HARD DRIVE.

When will optical drives be as fast as hard drives? At Pinnacle, and only Pinnacle, we proudly answer... today! Introducing the PMO-650™, a high speed 650 MB rewritable optical drive featuring Pinnacle's own OHD™



OHD-650 mechanism by Pinnacle Micro

(Optical Hard Drive) mechanism. The PMO-650 works like a hard drive, feels like a hard drive, but it's better - it's optical.

And with optical there are many advantages: removability, reliability, infinite capacity and a low cost per megabyte of disk storage.

Pinnacle's R&D center, located in Colorado Springs, CO, is one of the most advanced optical research and development facilities in the country. The Pinnacle R&D Center is now the leader in optical drive performance and innovation.

The PMO-650 is faster than a Seagate® ST4350N magnetic hard drive and five times faster than Sony's® SMO-E501 optical drive. With speeds faster than most hard drives, the PMO-650's applications are endless. It can replace existing hard drives for general data storage or can be used for vertical applications such as digital audio, digital video or multimedia. The PMO-650 is the ultimate storage system. It's more than a hard drive. It's optical.



XXBENCH TEST XCOPY.EXE DISK TRANSFER				
Drive Tested	5 Mb transfer	10 Mb transfer	50 Mb transfer	100 Mb transfer
ELAPSED TIME IN SECONDS				
Pinnacle PMO-650™	38.44	74.28	457.77	921.28
Sony SMO-E501	185.04	396.31	2941.88	4995.14
Seagate® ST4350N 350MB	61.26	125.06	819.79	1520.14

## PMO-650 FEATURES

- ◆ 3600 RPM rotation speed
- ◆ 19 msec effective access time\*
- ◆ MTBF: 30,000 hours
- ◆ Ultra light optic head
- ◆ Split Optic Design
- ◆ ISO/ANSI Standard compliant
- ◆ Direct seek technology
- ◆ Data queuing on reads/writes
- ◆ 20 MHz processor/design
- ◆ Horizontal and vertical mounting
- ◆ Dust-resistant design
- ◆ Plug-and-play ready for IBM AT/XT, PS/2 and Compatibles, MAC, SUN, HP, Silicon Graphics and others.

Circle 147 on Inquiry Card  
(RESELLERS: 148).

800-553-7070

PINNACLE MICRO

THE OPTICAL STORAGE COMPANY



## FileMaker Pro 2.0 Unites the PC and Mac

I feel like a keyboard virtuoso. Here I sit: a PC to the right of me, and a Mac to the left of me. Both are running beta versions of **FileMaker Pro 2.0**. But it doesn't take many years of practice to create elegant works of...er...database art with these database programs.

Even though I do my day-to-day work on a PC, I have always had a soft spot in my reviewer's heart for Claris's FileMaker. Although up until now the program has been available only on the Mac, its ease of use and power were almost enough of a temptation to move my database work to the Mac platform. Almost.

I don't have to make that hard choice any longer, because Claris continues its move into the Windows market. FileMaker Pro 2.0 for Windows runs on my PC, and both versions—Windows and Mac—add a raft of new features that make the packages even more powerful.

Of course, it's not just a matter of choosing a platform. Many business users have computer networks that include both Macs and PCs. In these cross-platform installations, sharing data has become a major concern and a major problem, creating a hot market in utilities that convert disparate file formats into something that "foreign" machines can read. There are no such problems with databases created with either version of FileMaker Pro 2.0; files are completely compatible at the binary level across the Mac and PC platforms.

Both versions of FileMaker Pro 2.0 are network-ready out of the box, licensed for up to 25 users. If they're set up on a server in a multiuser configuration, files are automatically updated across the network and even across platforms. Plainly, Claris has set up these packages for the way that business works today. But stand-alone computer users shouldn't fret; FileMaker Pro 2.0 is full of power that any user can take good advantage of.

Whether you think that GUIs are the computer gods' gift to mankind or a curse, you have to admit that they've taken the market by storm. They have enforced a graphics-oriented way of interacting with the world of your computer. After working with both versions of FileMaker Pro 2.0 for several weeks, I've become nonplussed by how very close Windows and the Mac



Desktop are. Except for the little apple in the upper left-hand corner of the Mac screen, it's difficult to tell which platform I'm working with.

Claris has put a huge amount of effort into making the two versions work almost exactly alike, while retaining the unique advantages of each platform. The company has succeeded, in spades. (A Claris spokesperson told me the applications share 85 percent of common code, with the remaining 15 percent given over to the idiosyncrasies of each GUI.)

What really sets FileMaker Pro 2.0 apart from the behemoths of the database market (i.e., dBase, Paradox, FoxBase, and Oracle) is that it lets users—even rank beginners—create sophisticated and powerful applications without the need to call in a high-priced database consultant. The key is FileMaker Pro's versatility. Most sophisticated database managers require you to do a great deal of preplanning, deciding exactly which fields you need and the exact number of characters designated for each. In the real world, things change; but most database managers aren't set up for change. FileMaker Pro 2.0 is a different beast. You just start entering field names. If you need to go back and change them later, no problem.

One of the thoughtful features of FileMaker Pro 2.0 is that you don't have to enter a length for data fields. There's none of the usual flipping through your Rolodex trying to figure out which client has the longest name. Each field can contain up to 64,000 characters. This presents some intriguing possibilities, such as storing form letters in your database.

Of course, there's much more. With

built-in drawing tools, you can customize the look and feel of on-screen forms and even integrate images using graphics files. FileMaker Pro 2.0 automatically creates indexes for all words as they're entered. The end result is incredibly fast searching and sorting.

If you're an advanced database aficionado, Claris hasn't forgotten you. There's a wide range of advanced features (e.g., Boolean searches and scripts), all accessed from a graphical object-oriented interface. These are packages that will give your mouse a thorough workout.

FileMaker Pro has one of the largest and most loyal networks of developers who design custom applications. That's sure to increase with the availability of the Windows version. If you don't want to create a database application yourself, chances are it's available. With FileMaker Pro 2.0 for Windows and the Mac, the two computers in my office are finally on speaking terms.

—Stan Miastkowski

## THE FACTS

### FileMaker Pro 2.0 for Windows \$399

#### System requirements:

A 386SX or higher PC is recommended with Windows 3.0 or higher and a hard drive; 4 MB of RAM is recommended.

### FileMaker Pro 2.0 for Macintosh \$399

#### System requirements:

A Mac Classic, SE, LC, II, Portable, PowerBook, or Quadra with System 6.0 or higher and a hard drive; 4 MB of RAM is recommended.

Claris Corp.  
P.O. Box 58168  
Santa Clara, CA 95052  
(800) 544-8554  
(408) 727-8227

Circle 1055 on Inquiry Card.



# BEFORE PROTECTING YOUR SOFTWARE...

SEE US AT  
**COMDEX/Fall '92**  
Booth # 5886

...against piracy and unauthorized use, make sure that your protection system has all the following qualities:

## A GOOD HARDWARE KEY

Hardware-based software protection systems are now the standard worldwide. However, not all keys are the same. A good key should have all the following features:

✓ Compatibility and transparency. The key should work without any problem on your customers' computers. The user should be able to forget the key after connecting it.



✓ Unbreakable electronics. A customized ASIC (Application Specific Integrated Circuit) component should be integrated in the key. This prevents reverse engineering and makes cracking virtually impossible.

✓ A unique and inaccessible software developer's code burnt into the ASIC. (This code should not be held in the key's memory, where it can be read and altered.)

✓ A Read/Write Memory inside the key should be available on demand. The memory should be writable in the field, on any PC, without any special programming equipment.

✓ Very low power consumption, enabling the key to work even under the worst power conditions, on PCs and laptops, with or without a printer.

## POWERFUL SOFTWARE

Since it's practically impossible to crack or duplicate a key having all the features mentioned above, a pirate will usually go for the software linking the protected program to the key. Therefore, check that your protection software has all of the following:

✓ A Linkable Protection Module with which calls can be made to the key from any point in the protected program.



✓ An "Envelope" installation program. Such programs enhance security while making it possible to protect a software even without its source code.

✓ Sophisticated antidebugging and encryption mechanisms.

## HASP®, THE PROFESSIONAL SOFTWARE PROTECTION SYSTEM, OFFERS YOU ALL THESE FEATURES AND MORE:

HASP was designed by a team of computer experts, professional cryptologists, and electrical engineers. As a result, HASP keys are supported by what is probably the best software in the market, and the HASP system has worked on every computer it has been tried on. In addition to all the features mentioned above, HASP provides:

✓ A Full Authorization

System for protecting dozens of programs using only one key.

✓ A Pattern Code Security System (PCS)

enabling parallel processing of multiple calls by the Linkable Protection Module.

✓ A Virus Detection option that can be incorporated in the protected program to check whether it has been infected by a virus or tampered with in any way.

✓ Several HASP keys can be daisy-chained.



## NETHASP, SOFTWARE PROTECTION FOR NETWORKS

✓ Only **one** NetHASP key is needed to run a protected program from many stations in a network. NetHASP provides full support for protecting DOS and WINDOWS software under network environments, including Novell dedicated & non-dedicated servers, Lan Manager, Lantastic, Banyan, DLink, and NET-BIOS based LANs.

**IN A TEST CARRIED OUT BY AN INDEPENDENT LAB, HASP WAS THE ONLY KEY WHICH WAS NOT BROKEN\*.**

## OPERATING ENVIRONMENTS

✓ **PC:** DOS, WINDOWS, OS/2, SCO UNIX, SCO XENIX, AIX, AUTOCAD, DOS EXTENDERS

✓ **MAC (ADB Port):** System 6.0.5 and up

✓ **NEC (Serial Port):** DOS, WINDOWS

## AND THE BOTTOM LINE:

We offer some of the most competitive prices in the market.

Since 1984, HASP has enabled thousands of software producers in more than 40 countries, including several Fortune 500 companies, to protect their software.

To learn more about why so many professionals have chosen HASP, please contact:

**ALADDIN**  
KNOWLEDGE  
SYSTEMS LTD.

15 Beit Oved St., Tel-Aviv, Israel  
P.O.Box:11141 Tel-Aviv 61110  
Tel: 972-3-5375795  
Fax: 972-3-5375796

In North America:

## ALADDIN SOFTWARE SECURITY

200 Broadhollow Rd., Suite #207  
Melville, NY 11747, USA  
☎ 800-223 4277, 516-424 5100  
Fax: 516-424 8300

- Australia Conlab Pty. Ltd., Tel: 3 8985685
- Belgium Akkermans bvba, Tel: 3 2338826
- CSFR ATLAS Ltd., Tel+Fax: 2 766085
- Chile Micrologica S.A., Tel: 562 222 1388
- Denmark SC Metric a/s, Tel: 42 804200
- France Logidata Intl., Tel: 50707375
- Germany CSS GmbH, Tel: 0201 74 986-0
- Greece Unibrain SA, Tel: 1 6856320
- Holland Akkermans BV, Tel: 45 241444
- Italy Partner Data S.r.l., Tel: 2 33101709
- Korea Hanil System Inc., Tel: 2 5639161
- New Zealand Training Solutions, Tel: 4 5666014
- Poland Systherm Tel: 061 45065
- Portugal Futurmatica Lda., Tel: 1 4116269
- South Africa D Le Roux, Tel: 11 886 4704
- Spain PC Hardware, Tel: 3 4493193
- Switzerland Opag AG, Tel: 61 7112245
- Taiwan Teco Ltd., Tel: 02 555 9676
- Turkey Mikrobeta Ltd., Tel: 4-4677504

\* CT Magazine, May 1990.

© Aladdin Knowledge Systems Ltd. 1985-1992



## Amstrad's Low-End Bid for the Portable Market

**B**RENTWOOD, ENGLAND—U.K.-based Amstrad has announced a Z80-based notebook computer, some 15 years after the launching of the Z80. Although it seems astonishing that a major PC vendor should announce a machine based on such old technology, Alan Sugar, Amstrad's managing director, believes his company will sell between 200,000 and 300,000 machines in the first year.

The 2-pound **Amstrad Notepad NC100** includes 64 KB of SRAM (static RAM); the only other storage is provided by a PCMCIA 2.0 slot (unfortunately, it's memory only). The machine is shipped with a number of standard applications, including a word processor, a simple card-file database, a time manager, a calendar, a BASIC interpreter, and a terminal emulation program. The 80-column, 8-row super-twist LCD sits in a raised bezel above the multicolored 64-key keyboard.

Amstrad has built ease of use into its notebook, the key to which is a row of colored buttons on the bottom left of the keyboard. These buttons let you task-switch among the three main applications, as well as letting a new user immediately understand the on-screen instructions. "Hit F10"



has a PC novice scouring the keyboard, whereas "Press the red key" is easily understood. Using my evaluation unit, a PC novice rather quickly created a short document in the word processor by following the simple on-screen instructions.

The Protext word processor was developed for Amstrad by Arnor, a U.K. company with versions of its word processor on the PC, Atari ST, and Amiga. The software is full-featured, with a 50,000-word spelling checker, and it uses the same file format as Protext on other platforms.

The card file is simple, offering just four fields for storing name, address, phone,

and fax information. The diary facility is more complete, including alarms, events, and international time zones. The BASIC interpreter is a version of BBC BASIC that offers some limited user programming facilities.

Sugar says the company believes the key to the success of the NC100 will be the friendliness of the software. He is backing his words with the promise that "if you can't use this computer in 5 minutes, you'll get your money back," a statement that's being included in the company's ads.

—Andy Redfern

### THE FACTS

**Amstrad Notepad NC100**  
about \$300 (£170)

Amstrad plc  
169 Kings Rd.  
Brentwood  
Essex CM14 14ER  
U.K.  
44-277-228888  
fax: 44-277-211350  
**Circle 1056 on Inquiry Card.**

## ScanMan Color: Handing It to Logitech

**A**bout two years ago, Logitech stood by while numerous vendors trumpeted the release of their hand-held color scanners. The company waited to examine these products—and accompanying second-sourced software that often fit like a borrowed suit—and finally released its own color product. The result, the \$699 **ScanMan Color**, shows that Logitech's time was well spent.

Announced in June, the product that hit the shelves in September is a 24-bit model, which translates into more than 16.7 million colors the hardware can sense. Gray-scale scanning, which you can do without converting from color (conversion is another route), gets you 256-gray-scale sensitivity. And if you plan OCR (optical character recognition) work despite hand scanners' inherent limitations

for text accuracy, a line-art mode is available, too.

Software included is Logitech's Windows-based FotoTouch Color, an expanded version of the software included with other Logitech scanners. Closely integrated is the company's ScanMan Color software, which forms the interface between image editor and scanner. Owing to the product's compliance with the multivendor TWAIN (Toolkit Without An Important Name) protocol for incorporating graphics into documents, FotoTouch will accept images from ScanMan Color and any product written to this API.

Installing the ScanMan Color is a welcome improvement over the old IRQ (interrupt request) game that has vexed users of most older models. True, you may need to change DIP switches on the 16-bit board

to keep the base I/O address from conflicting with other devices. The default setting of 280h, in fact, initially conflicted with my Artisoft LANtastic network card. From there, however, the software automatically finds an available IRQ. If you forget the I/O address you've set, a software installation test routine lets you select each possible setting on-line until the software recognizes the hardware.

On the scanner itself are a resolution switch in 100-dot-per-inch increments up to 400 dpi and a contrast dial. A topside indicator lights a steady green when you're scanning at the proper speed or blinks if you're rushing.

Operating the ScanMan Color is refreshing in that it requires none of the 30- to 90-second warm-up that is the bane of typical hand-scanner use. The software



“...the industry's best keyboard.”

— *Personal Computing*

“...a byword for quality and tactile feedback...” — *Which Computer?*

“...it's the leader among computer keyboards.” — *PC Magazine*

“...nobody has been able to match the quality...” — *PC World*

## Now We'd Like To Give You A Quote On Price.

The “industry's best keyboard” is now for sale. If you're putting together systems or need keyboards customized for your OEM operation, we make the best, in 35 languages. Call (33) 38 83 4308 in Europe, or 1-800-777-4886 in the U.S.A. Our quotes will impress you as much as those above.

Lexmark International, Inc., a former division of IBM®, is an independent, worldwide company that

develops, manufactures, and markets IBM personal printers, IBM typewriters, related supplies and keyboards.



**LEXMARK**™

Circle 203 on Inquiry Card (RESELLERS: 204).

Fax (33) 38 83 4048 in Europe, (606) 232-7241 in U. S. A. IBM is a registered trademark of International Business Machines Corporation in the United States and/or other countries, and used under license. PC Magazine Editors' Choice logo, © 1985 Ziff Communications Company. PC Magazine and PC Magazine Editors' Choice are registered trademarks of Ziff Communications Company. Quotes above reprinted with the permission of Personal Computing, March 1989; Which Computer?, July 1989; PC Magazine, January 17, 1990; and PC World, "The Hardware Shelf", Michael Goodwin, February, 1988. Lexmark is a trademark of Lexmark International, Inc. © Lexmark International, 1992.



needs several seconds to display the image once you've scanned it—it is Windows-based, after all—but the hardware remains at the ready.

The FotoTouch Color software is the magic of the scanner package. All the image-retouching features you'll find elsewhere are present, but a welcome addition is the ability to customize the panel of editing tools along the side. Easily accessible sliding switches allow you to adjust your scanned image's tone control, color balance, and enhancements for smoothing edited images. A color wheel and gray-scale bar let you change the foreground and background. Viewing options are aplenty. And if you want to export the image, your choices include BMP, PCX,

EPS, GIF, and four varieties of TIFF.

Throughout my testing with various graphics and text images, the ScanMan Color performed admirably; the usual hitch, editing a 24-bit image on standard VGA, is hardly the scanner's weakness. Even the stitching of four passes of a single large image—the hand scanner's traditional stumbling block—proved to be little trouble.

If you plan heavy OCR work, you're still better off with a desktop scanner. But if you'll be scanning graphics for desktop publishing or presentations with the occasional text scan, go with the product from a company that has learned from others' mistakes.

—Ed Perratore

### THE FACTS

**ScanMan Color**  
\$699

#### System requirements:

A 386SX with VGA graphics, Windows 3.0 or 3.1, 4 MB of RAM, 5 MB of free disk space, and a mouse.

Logitech, Inc.  
6505 Kaiser Dr.  
Fremont, CA 94555  
(510) 795-8500  
fax: (510) 792-8901

**Circle 1057 on Inquiry Card.**

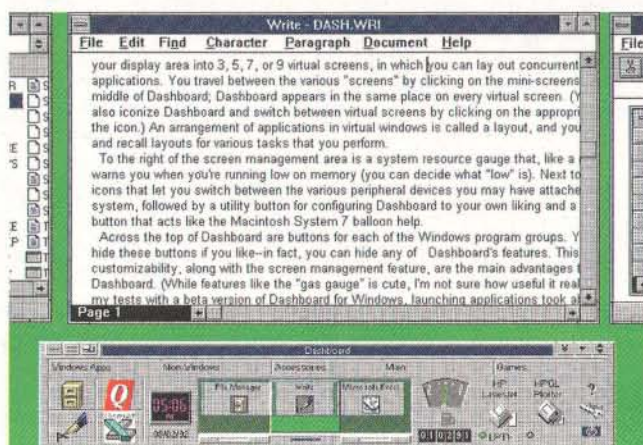
## HP's Push-Button Dashboard for Windows

Suppose you're a Windows user, but you don't like the Program Manager that comes with it. You'd like a different method of switching between tasks, arranging your program groups, and so on.

**Dashboard for Windows** is a new shell/utility that lets you do just that. Developed by the NewWave division of Hewlett-Packard, Dashboard provides many of the same functions as the Program Manager and adds some new ones, while taking up less of your desktop and system resources. In these days of massive programs, every little bit of RAM that you can save helps.

In its maximized state, Dashboard for Windows is a horizontal panel, as shown in the screen above. At the far left are Quick Launch push buttons (between one and 32) that let you start your most commonly used programs with a single click. Next to those is a customizable alarm clock that will remind you of an appointment or start an application at a specific time.

Dashboard's most interesting feature is extended screen management, which allows you to stretch your display area into three, five, seven, or nine virtual screens, in which you can lay out concurrently running applications. You travel between the various "screens" by clicking on the mini-screens in the middle of Dashboard; Dashboard appears in the same place on every virtual screen. (You can also iconize Dashboard and switch between virtual screens



by clicking on the appropriate part of the icon.) An arrangement of applications in virtual windows is called a layout, and you can save and recall layouts for various tasks that you perform.

To the right of the screen management area is a system resource gauge that, like a gas gauge, warns you when you're running low on memory (you can decide what "low" is). Next to the gauge are icons that let you switch between the various peripheral devices you have attached to your system, followed by a utility button for configuring Dashboard to your own liking and a help button that acts like the Macintosh System 7.0 Balloon Help.

Across the top are buttons for each of the Windows program groups. You can hide these buttons if you like—in fact, you can hide any of Dashboard's features. This customizability, along with the screen

management feature, are the main advantages to using Dashboard. In my tests with a beta version of the software, launching applications took about the same time as it did from the Program Manager, which lets you perform most of the other functions of Dashboard, albeit differently.

Arranging applications, utilities; and resources on your desktop is a bit like arranging furniture. The space defines much of what you can do, and people's tastes vary. If you need a utility to supplement the Program Manager, Dashboard for Windows deserves a look. ■

—Kenneth M. Sheldon

### THE FACTS

**Dashboard for Windows**  
\$99

#### System requirements:

Windows 3.0 or higher.

Hewlett-Packard Co.  
974 East Arques Ave.  
Sunnyvale, CA 94086  
(800) 554-1305  
(408) 720-3441  
fax: (408) 720-4033

**Circle 1058 on Inquiry Card.**



# Programmer's Paradise®

See us at  
**COMDEX!**  
Booth# H7442

## WATCOM SQL Developer's Edition

Complete client/server development tool allows you to develop and deploy single-user standalone applications, and to develop applications for use with the Network Server Edition (sold separately). Includes: Single-user database server (both 16 and 32-bit versions); ACME application development system; Embedded SQL/C preprocessor; SQL libraries for WATCOM C, C/386, MS C/C++ and BC/C++.

**List: \$795** **Call for special introductory price!**  
**FAXcetera #: 1683-0010**



## N-TRAIN™

**N-TRAIN for C:** The ultimate neural network function library. Fast, powerful, numerically stable, easy to use. Takes full advantage of 386/486 hardware. Available for Zortech C/C++ and other popular 32-bit compilers.

**N-TRAIN for neural shell:** Industrial strength neural network development system. Trains nets *fast*, handles huge problems reliably.

<b>C Library</b>	<b>List: \$329</b>	<b>Ours: \$289</b>
<b>w/source</b>	<b>List: \$469</b>	<b>Ours: \$419</b>
<b>Devel. System</b>	<b>List: \$747</b>	<b>Ours: \$669</b>

**FAXcetera #: 1004-5401**

## GUARANTEED BEST PRICES\*

Should you see one of these products listed at a lower price in another ad in this magazine, **CALL US!** We'll match the price, and still offer our same quality service and support!

### Terms of offer:

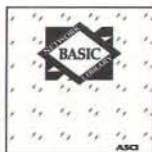
- \* Offer good through October 31, 1992
- \* Applicable to pricing on current versions of software listed.
- \* October issue prices only.
- \* Offer does not apply towards obvious errors in competitors' ads.
- \* Subject to same terms and conditions

## BASIC Network Library Network C Library

The most comprehensive libraries available for NetWare software development, supporting all versions of advanced NetWare including 3.11. Over 450 C functions and 300 BASIC functions. Include any features from the NetWare command line utilities and menu utilities in your C or BASIC program. No licensing hassles. C library source code available.

<b>BASIC Library</b>	<b>List: \$265</b>	<b>Ours: \$229</b>
<b>C Library</b>	<b>List: \$295</b>	<b>Ours: \$259</b>

**FAXcetera #: 1004-9201**



## Clarion Prof. Developer

A fully equipped development system for producing PC applications. Includes an application generator for creating screens, windows, tables, menus, and reports. Also contains Report Writer, a powerful ad-hoc query utility. Speed, flexibility and ease-of-use give you the power to create much richer programs, in a fraction of the time.

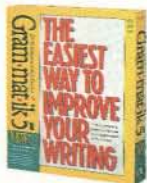
**List: \$845** **Ours: \$525 NOW \$475**  
**FAXcetera #: 1862-0002**

**SPECIAL!**

## Grammatik 5

Grammatik 5 proofreads documents for hundreds of thousands of errors in grammar, style, spelling, punctuation, and usage. Grammatik 5 works inside all major Windows word processors, and proofreads text from any Windows application. Grammatik also works inside all major DOS word processors, and can proofread files created in every other text-based application. It's the easiest way to improve your grammar.

**List: \$99** **Ours: \$69**  
**FAXcetera #: 0222-0001**



## Outside In for Windows

Outside In for Windows is a file viewing and data import utility. Use it to copy data from 90 word processing, database and spreadsheet formats to the Clipboard with formatting intact. It also prints files and launches applications. Use it as a standalone utility or as part of Norton Desktop, Windows 3.1 or the major word processors. Outside In supports DOS, Windows and Macintosh files.

**List: \$89** **Ours: \$69**  
**FAXcetera #: 1001-2001**



## TSRific

The multilingual tool for TSR development. TSRific is the toolkit you need for developing memory efficient and reliable TSRs. It takes just one function call to turn your program into a powerful TSR. Swaps to XMS, EMS, or disk. Saves/restores text and graphics. User definable Hotkey. Automatically handles interrupt conflicts. No royalties.

**List: \$99** **Ours: \$89**  
**FAXcetera #: 2089-0018**



## Instant-C 5.0

The Instant-C professional programming environment integrates the edit-compile-link-test cycle in one powerful, high performance tool. It combines an incremental compiler and linker with automatic static and runtime error detection (e.g., use of uninitialized pointers, source level debugging, interactive C expression evaluation, and support of programs up to 16MB).

**List: \$495** **Ours: \$445 NOW: \$325**  
**FAXcetera #: 1067-0001**

**Call Programmer's Paradise® Today!**  
**And mention this ad when placing your order!**

**1-800-445-7899**

Corporate: 800-422-6507  
(CORSOFT Division)

800-445-7899





# Programmer's Paradise The Software Source

*Developers, we're here to serve you. Programmer's Paradise offers the world's largest selection of software development tools and utilities at guaranteed low prices. If you don't see what you want, call us! And don't forget to ask for our free comprehensive catalog.*

## METAWARE HIGH C/C++

MetaWare, Inc. announces its newest product. The 32-bit High C/C++ compiler version 3.0 is a true compiler, not a C to C++ translator. "Incremental Strengths" let you specify the level of C++ compilation, allowing you to migrate from C to C++ one C++ block at a time. Included in this package is a C++ tailored source-level debugger and a 32-bit Application Development Kit for Windows. MetaWare offers a full line of multi-language, multi-platform compilers for professional software developers.

List: \$795 Ours: \$669  
FAXcetera #1590-0008



## 386/486 Development

Intel 386/486 C Code Builder	575
Lahey EM/32 5.0	1015
MetaWare High C/C++	669
Phar Lap 386i DOS-Extender	445
Prof. Pascal Ext. DOS	749
WATCOM C9.0/386	719
Zortech C++ Devel. 3.0	445

## Basic

dB/Lib Professional	170
GFA Basic for Windows	235
MS Basic PDS	349
ProBas 5.0	169
Q+E Database/VB	CALL
Realizer	CALL
Visual Basic/Win	139
Visual Basic & Tkt Bundle	228
Visual Basic for DOS	139
Professional	325
Competitive Upgrade	CALL

## C/C++ Compilers

Borland C++	349
Borland C++ w/App.	
Frameworks	539
High C/C++	CALL
Microsoft C/C++ 7.0	325
MS QuickC for Windows	139
Turbo C++	75
for Windows	112

## C-Application Generators

CASE-W Corporate	895
dANALYST GOLD	89
PRO-C	99
WindowsMAKER Prof.	795

## PRODUCT OF THE MONTH

### Microsoft Visual Basic for DOS Prof. Edition

Award-winning productivity -- now available for DOS! Draw forms and controls, write event-procedures, use and create custom controls -- in DOS! Create all-new apps or combine with existing C/C++ or Pascal code. Highly compatible with VB/Win for multi-platform development. Even run existing MS Quick Basic/Basic PDS code! Includes a native 80x86 compiler that creates 100% standalone .EXE files, 386 code generation, MOVE overlays, an integrated ISAM and much more!

List: \$495 Ours: \$325  
FAXcetera #1269-0039

## Dan Bricklin's Demo II

Experience for yourself why 30,000 people have made Demo II 3.0 the leading tool for producing program prototypes, demonstrations, and tutorials. Demonstrate commercial software to potential customers without shipping live software. Produce effective tutorials that interactively teach products. Create Computer Based Training for a fraction of the cost of dedicated CBT authoring software.

List: \$249 Ours: \$215  
FAXcetera #0233-0003



## C Communications

BreakOut II	225
C Async Manager	175
C Comm Toolkit	139
Essential Comm	295
Greenleaf CommLib	339
Greenleaf ViewComm	319
QuickComm	119
SilverComm C Async	195

## C Screens

C-scape	4
C Windows Toolkit 386	1
Greenleaf Data Windows	3
Instant Windows	4
Island Pro Pak	4
QuickWindows Advanced	1
VC Screen	1
Vitamin C	3

## Lahey F77L-EM/32

Industry leading 32-bit FORTRAN Language System includes Phar Lap's 386iDOS-Extender. This VCPi, XMS, and DPML compliant extender enables users to access up to 4GB and operate in the MS Windows DOS box. The extender is royalty-free and includes virtual memory support. New with Version 5.0: 32-bit debugger, arrays beyond 16MB, compression linker, and 486 optimizations. Support for popular VAX, IBM VS, and 90 features.

List: \$1195 Ours: \$1015  
FAXcetera #1476-0004



## C- Additional Products

C-Doc	1
C-Doc Professional	2
MKS LEX & YACC	1
PC Lint	1
Phar Lap 286iDOS-Extender	4

## C++ Libraries/Utilities

C++Views	4
Codebase 4.5	2
Greenleaf Comm++	1
object-Menu	2
Object Professional for C++	1
Poet	3
Rogue Wave Math.h++	2
Rogue Wave Tools.h++	2
Style	1
Win++	1
Zinc 3.0	3
Zinc Competitive Upgrade	2

International: 908-389-9228  
Customer Service: 908-389-9229

Canada: 800-445-7899  
Fax: 908-389-9227

# CALL US

800-445-7899



# Paradise<sup>®</sup> ce for Developers!

See us at  
COMDEX!  
Booth# H923

## Database Development

Arion Prof.	449
pper	CALL
taBoss 3.5	CALL
ASE IV	569
kPro	489
kPro Competitive Upg.	CALL
kPro Distribution Kit	CALL
radox 3.5	569
E Database Library	279
R Code Generator	179
verClip/Fox SPCS	239
ATCOM SQL Dev. Edit.	CALL
etwork Server Edition	CALL

## Pascal

Topaz	89
Turbo Pascal for Windows	112
Turbo Pascal Professional	225
Turbo Professional	109
<b>Prototyping</b>	
Dan Bricklin's Demo II	215
Show Partner F/X	315
<b>Version Control</b>	
MKS RCS	CALL
Sourcerer's Apprentice	CALL
SourceSafe	199
TJJB	125

## Utilities

386MAX	72
After Dark	32
Bar Code Library	350
Blue MAX	91
Dr. Switch-ASE	159
DVT (Data Vis. Tool)	CALL
HIJAAK	139
Hold Everything	179
Iconic/Query	219
INSTALT	135
Label Master	429
MKS Toolkit	199
Norton Anti-Virus	99
Norton Commander	99
Norton Utilities 6.0	129
Opt-Tech Sort/Merge	119
PC Tools Deluxe 7.0	129
QEMM 386	68
SpinRite II SPECIAL!	59
UpShot	139

## WATCOM C 9.0/386

Develop and debug 32-bit applications for extended DOS, Windows, and OS/2 2.0 with the most complete 32-bit C development package available. Includes the royalty-free DOS/4GW DOS extender by Rational Systems, components from MS Windows SDK, compiler, linker, debugger, profiler, plus numerous development tools. Supports other industry standard 32-bit DOS extenders. Create ADS Applications for AutoCAD or embedded systems development.

List: \$895      Ours: \$719  
FAXcetera #1683-0001



## ProtoGen 3.0

**NEW VERSION!** The industry standard for code generation and prototyping Windows application. Develop the user interface of your application using Visual prototyping methods. ProtoGen generates expert level, commented code for ANSI C, Microsoft MFC C++, Borland OWL C++, Turbo Pascal, and Microsoft NT Win32. All generators included! User Code is preserved from one generation to the next. It's easy and fast.

List: \$199      Ours: \$99  
FAXcetera #2553-0002



## GUARANTEED BEST PRICES\*

Should you see one of these products listed at a lower price in another ad in this magazine, **CALL US!** We'll match the price, and still offer our same quality service and support!

### Terms of offer:

- \* Offer good through October 31, 1992
- \* Applicable to pricing on current versions of software listed.
- \* October issue prices only.
- \* Offer does not apply towards obvious errors in competitors' ads.
- \* Subject to same terms and conditions

## WindowsMAKER Professional 4.0

**NEW VERSION!** Next generation of industry standard C/C++ development tool for Windows. The easiest, fastest way to create Windows apps, just point and click. New architecture uses Switch-It™ Code Generation Modules for generating ANSI C, MFC C++ or OWL C++ code, among others. Award-winning Visual Prototyper lets you test the look & feel and make changes on the fly. TrueCode technology ensures that user code is preserved during code regeneration. Generates Windows .EXE w/fully commented C or C++ source. CUA & SAA compliant.

List: \$995      Ours: \$795  
FAXcetera #2602-0003



## Editors

ef	179
<b>NEW!</b>	CALL
ulti Edit	89
ulti Edit Professional	139
ckEdit	149
dit Plus	149

## FORTRAN

ey F77-EM/32 5.0	1015
ey F77L	535
\$ FORTRAN	349
ATCOM FORTRAN 77 9.0	449

## Graphic Libraries

by Driver II	239
ACKHAWK dGT	310
ential Graphics GUI	135
ential Graphics Kernal	179
st/Drive Plus Dev.	269
raphics-MENU	209
Effects 2.0	179
Graphics	224
Text 2.0	134
YN-TOOLS	135
ageMan	359
nuet	319
PCAD/3D	79
L	179
L 2D, 3D	CALL
tor Image Library	179

## Linkers/Profilers

Link/Plus	445
inker	269
nk86+	335

## Windows Development

CODEPAD for Windows	69
dBFast Windows	395
InstallSHIELD	359
Magic Fields	CALL
MS Test	272
Norton Desktop 2.0 f/ Windows	125
ObjectVision	109
ProtoGen SPECIAL!	99
RoboHelp	449
Realizer	CALL
Smalltalk V/Windows	395
SQA: Robot	449
WindowsMAKER Prof.	795
Windows Teach	110
zApp	175

## Phone Orders

Mon-Fri 8:30 AM-8PM EST, Sat 9:30-2:30 EST. We accept MC, Visa, AMEX. Domestic shipments, please add \$6 per item for shipping/handling. Items which weigh fifteen pounds or more will be charged at actual UPS ground rates. Domestic COD shipments, please add \$4. Rush service available.

**Mail or FAX / International Orders/ Domestic Purchase Orders** Phone number required.

**Returns** Subject to \$25 processing charge per product.

**FAXcetera® (908) 389-8173** Call from your FAX telephone and follow the instructions to receive more information on the products featured above!

**Corporate Accounts** Call CORISOFT, our corporate sales division. Ask about volume purchase agreements.

\* All prices subject to change without notice.

**TODAY!**

**800-445-7899**

**CORPORATE (CORISOFT): 800 422-6507**

Circle 124 on Inquiry Card.

**CALL**

**800-445-7899**





### Minitower Multimedia

**T**he minitower MPC-I 486-33 puts multimedia capabilities at your fingertips. The unit has 4 MB of RAM (expandable to 32 MB), 64 KB of cache memory, two floppy drives, a 120-MB hard drive, and an NEC Intersect CD-ROM drive with an access speed of 280 ms.

A Media Vision Pro Audio Spectrum 16-bit card provides audio for two 20-W external speakers from Acoustic Research, and an ADI 14-inch noninterlaced Super VGA monitor comes with a 16-bit graphics board with an S3 graphics accelerator chip set. DOS 5.0, Windows 3.1, and a 400-dpi high-resolution bus mouse round out the package.

**Price:** Base unit, \$3985.

**Contact:** Clover Computer Systems, Inc., 1430 Koll Cir., Suite 102, San Jose, CA 95112, (408) 436-0444; fax (408) 436-0494.

**Circle 1271 on Inquiry Card.**

### Keyboard Computer

**A** keyboard that's a complete 33-MHz 386SX system, the PC-101 includes 1 MB of DRAM (expandable to 16 MB) with auto-sensing memory capability. A slot for an 8- or 16-bit network card lets you connect the unit to your LAN for use as a workstation. The unit has controllers for a 1.44-MB floppy drive and an IDE hard drive,



*DataBusiness's PC-101 puts 33-MHz 386SX power in a keyboard.*



*Clover Computer Systems' MPC-I has real-time window manipulation and a chroma key for overlaying finished live images on a VGA screen.*

and it has a built-in palm rest.

Internal interfaces on the system include three parallel and two serial ports, as well as two built-in video ports that can support 1024- by 768-pixel-resolution Super VGA, EGA, CGA, or Hercules monochrome graphics. Speaker volume control is also built in. External interfaces encompass ports for a PS/2 mouse, a bar code reader, a scanner or a light pen, and floppy or tape drives.

**Price:** \$1495.

**Contact:** DataBusiness Systems, 4630-102 Campus Dr., Newport Beach, CA 92660, (714) 252-0990.

**Circle 1272 on Inquiry Card.**

### Supercompact 386 Workstation

**D**esigned for graphics and multitasking environments, the MiStation 3 comes with a 32-bit 33-MHz 386DX

CPU, 4 MB of RAM (expandable to 32 MB), a 16-KB cache memory system, two serial ports, one parallel port, an IBM PS/2-compatible mouse port, a 101-/102-key keyboard, and two 16-bit full-length expansion slots. The slimline case has room for two 1-inch-height 3½-inch floppy drives and one half-height 3½-inch hard drive. A seven-tiered security system features keyboard, system control, and form-factor locks.

You can upgrade the MiStation 3 from its standard VGA graphics resolution of 1024 by 768 pixels in 16 colors to 1024 by 768 pixels in 256 colors, both in noninterlaced mode.

Options for the MiStation 3 include 40-, 120-, and 200-MB hard drives, monitors, a Mitac PS/2-compatible mouse, Ethernet cards, OS/2 1.21, Windows 3.0, and Microsoft Works 2.0.

**Price:** About \$1940 (£1019). **Contact:** Mitac (U.K.) Ltd., Unit 12, Hortonwood 32, Telford, Shropshire TF1 4EX, U.K., 44-952-670370; fax 44-952-605605.

**Circle 1273 on Inquiry Card.**

### Open Architecture Terminal

**W**ith an industry-standard SBus expansion slot and a Unix API-compatible micro kernel, the TX800C color Open Network Terminal can download and run a variety of terminal services in addition to X Window System terminal services. The expandable display terminal, designed to maximize local client-based processing, is able to interpret X commands at a rate of 104,000 Xstones per second.

The terminal comes with a local Motif or Open Look window manager and a software license. Options include a Turbo JPEG video image decompression card.

**Price:** Base model, \$3495; Turbo JPEG card, \$1495.

**Contact:** Visual, 120 Flinders Rd., Westboro, MA 01581, (508) 836-4400; fax (508) 366-4337.

**Circle 1274 on Inquiry Card.**

### Expandable Notebook

**T**he AquaLite-I 25-MHz 386SXL has a 1.44-MB floppy drive, a 60-MB hard drive, a backlit supertwist 9½-inch LCD with 640- by 480-pixel resolution, and 256 KB of video RAM for up to 32 gray levels. The unit's 2 MB of RAM is expandable to 8 MB. Interfaces include one parallel and two serial ports, and ports for a keyboard, a CRT, and a docking station. It also has a socket for a 387SXL math coprocessor.

**Price:** \$1995.

**Contact:** CAF Technology, Inc., 1315 Johnson Dr., City of Industry, CA 91745, (818) 369-3690; fax (818) 369-3692.

**Circle 1318 on Inquiry Card.**



### Back Up Via the Parallel Port

**A**ble to transfer data at up to 1 Mbps, the Trakker 250 plugs into the printer port of your notebook or desktop PC. A separate parallel connector on the back of the unit lets you operate a printer from the same port when you're not backing up data. Conforming to QIC 40 and QIC 80 industry standards, the tape backup system uses extended-length tapes and data compression to provide a data capacity of 250 MB on DC-2000 mini-cartridges. The unit supports multiple languages and is compatible with NetWare 286 and 386.

**Price:** \$549.

**Contact:** Colorado Memory Systems, Inc., 800 South Taft Ave., Loveland, CO 80537, (800) 451-0897 or (303) 669-8000; fax (303) 667-0921.

**Circle 1275 on Inquiry Card.**



*The plug-and-play Trakker tape backup device supports the enhanced PC parallel port.*

### Data Storage to Go

Three lightweight portable hard drives that come in small packages can help ease your data-storage problem while traveling.

**U**nison's Pocket Rocket, a 4 1/4- by 8 1/4- by 3 1/4-inch external SCSI hard drive, has an unformatted storage capacity of more than 1.3 GB, an average seek time of 10 ms, and a data transfer rate of 10 MBps. A 512-KB segmented cache buffer enhances throughput.

**Price:** \$2085.

**Contact:** Unison Information Systems, Ltd., 21 Walsh Way, Framingham, MA 01701, (508) 879-3200; fax (508) 879-0772.

**Circle 1277 on Inquiry Card.**



**T**he EasyStor Portable Data Module from UniStor plugs into the parallel port of your laptop or desktop PC. Able to transfer data at



up to 15 Mbps, the unit is available in 40- to 180-MB capacities. The 1 1/2- by 3 1/2- by 7-inch unit includes a 3-hour battery, hardware data encryption, and user password protection. EasyStor's Easy-Step device driver software quickly configures most PCs to automatically recognize its presence.

**Price:** \$599 to \$1199.

**Contact:** UniStor Corp., 23402 South Pointe Dr., Laguna Hills, CA 92653, (800) 422-2115 or (714) 581-3442; fax (714) 581-7564.

**Circle 1278 on Inquiry Card.**

**P**almDrive, a 1- by 3- by 5-inch external drive, transfers data at a rate of up to 5 MBps via its Stealth controller. The controller hides the drive from your PC's BIOS, so the system sees it as a device driver occupying only 2.5 KB of memory. The unit attaches to the PC via a quick-release cable that also supplies power to the drive from the PC.

**Price:** 40 MB, \$599; 80 MB, \$799; 120 MB, \$999.

**Contact:** ProTégé Corp., 3440-C West Warner Ave., Santa Ana, CA 92704, (714) 241-0891; fax (714) 241-1218.

**Circle 1279 on Inquiry Card.**

### Fast Data Transfer

**T**he AL-1000 high-speed SCSI adapter can transfer data at rates as high as 250 Kbps. A complete system, the adapter includes cables and advanced SCSI programming interface drivers and utilities for hard disks. Fixed and removable media in the package include optical, floptical, CD-ROM, and tape drives.

An innovative parallel-port inquiry scheme optimizes the AL-1000's performance, enabling you to use it with older computers that have unidirectional printer ports as well as with newer computers that have high-speed bidirectional and enhanced parallel ports. The system's portability enables you to connect your portable computer to such external peripherals as printers, hard drives, tape backup systems, and CD-ROMs.

**Price:** \$199.

**Contact:** Always Technology Corp., 31336 Via Colinas, Suite 101, Westlake Village, CA 91362, (818) 597-1400; fax (818) 597-1496.

**Circle 1280 on Inquiry Card.**

### Portable Personal Printer

**A**personal printer sized for tight spaces, the Coronajet 200j ink-jet printer has 300-dpi resolution for text and graphics. The unit includes Hewlett-Packard PCL 3+ emulation, 20 resident fonts, portrait and landscape modes, and a replaceable ink-jet cartridge. The 6 1/4-pound printer operates at less than 45 dB.

**Price:** \$499.

**Contact:** Smith Corona Corp., 65 Locust Ave., New Canaan, CT 06840, (203) 972-1471.

**Circle 1276 on Inquiry Card.**



### Watch TV on Your PC

**T**urn your PC into a full-screen TV with 50/50 Micro Electronics' PC/Television. The board includes a 119-channel tuner that handles VHF, UHF, and cable TV frequencies. You can connect the board to a coaxial cable, an external TV antenna, a VCR, a laserdisc player, a video camera, or an internal private-broadcast TV cable.

PC/Television, which fits into a standard 8-bit bus, is compatible with VGA and Super VGA graphics adapters and monitors that support VGA. You can work in a computer application and, with a keystroke, switch to watch TV, or you can listen to TV while you work and view your application on your monitor. You can select a channel, set your video display, and program channels from the keyboard or mouse.

**Price:** \$395.

**Contact:** 50/50 Micro Electronics, Inc., 550 Lakeside Dr., Suite 8, Sunnyvale, CA 94086, (408) 730-5050; fax (408) 732-5050.

**Circle 1281 on Inquiry Card.**

### PS/2 Performance Boosters

**T**he Stax SX 25 MHz and the MicroMaster 486SX 25 MHz boards upgrade PS/2 computers to 386SX and 486SX levels, respectively. The Stax SX 25 MHz increases the speed and performance of Models 50, 50 Z, and 60 and supports the 287 and 387 math coprocessors. The board supports Windows 3.1.

The MicroMaster 486SX 25 MHz, a bus master processor upgrade board, boosts the processing performance of the 286- and 386-based PS/2s. The board uses exist-



*PC/Television, which lets you control your TV from your PC, operates in noninterlaced mode.*

ing system memory and also supports up to 16 MB of 32-bit on-board memory.

**Price:** Stax SX 25 MHz, \$495; MicroMaster 486SX 25 MHz, \$1600.

**Contact:** Aox, Inc., 486 Totten Pond Rd., Waltham, MA 02154, (617) 890-4402.

**Circle 1282 on Inquiry Card.**

### High-Speed A/D Conversion

**T**he AIN-24 A/D conversion card comes with on-board cache and DMA for applications such as high-speed data capture, transient analysis, and general logging functions. DMA lets you transfer data to your PC's RAM at a rate of 80 kHz. You can configure the AIN-24 under software to have 24 single-ended channels or 12 differential channels.

Additional features on the AIN-24 include a software-selectable gain and software-

selectable input configuration. The package includes a DOS device driver that provides access to all the board's functions through minimal programming in most high-level languages.

**Price:** About \$846 (£495).

**Contact:** Blue Chip Technology, Hawarden Industrial Park, Manor Lane, Deeside, Clwyd CH5 3PP, U.K., 44-244-520222; fax 44-244-531043.

**Circle 1283 on Inquiry Card.**

### Capture Video in a Window

**A** real-time, true-color image capture and display card, the VIGA Window can accept video from three inde-

pendent video sources (e.g., NTSC, PAL, and S-Video). With the ability to scale multiple live video windows, VIGA Window lets you open a window within a window and manipulate, edit, store, and retrieve the captured images. The board, fully Windows 3.x compatible, can provide output to a VGA or multisync monitor at resolutions of up to 1024 by 512 pixels.

**Price:** \$695.

**Contact:** Visionetics International Corp., 21311 Hawthorne Blvd., Suite 235, Torrance, CA 90503, (310) 316-7940; fax (310) 316-7457.

**Circle 1284 on Inquiry Card.**

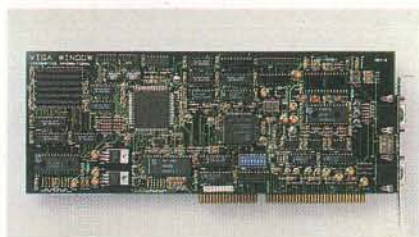
### The Local Bus Makes the Connection

**A** combination of a 24-bit graphics card and a 486 motherboard, FlickerFree ColorBahn and Genoa 486 TurboExpress work with the local bus to provide 16 million colors at 640- by 480-pixel resolution and 256 colors at 1024- by 768-pixel resolution. The card snaps into a local-bus slot on the 33-MHz or 50-MHz motherboard, which has a flexible cache memory of from 64 to 256 KB and up to 32 MB of DRAM.

**Price:** \$589 and up.

**Contact:** Genoa Systems Corp., 75 East Trimble Rd., San Jose, CA 95131, (408) 432-9090; fax (408) 434-0997.

**Circle 1285 on Inquiry Card.**



*VIGA Window provides full-motion digital video support.*



# Try stuffing these into a laptop.



Laptops have their place, but for mission-critical applications requiring serious expansion, workstation power, CRT-quality screens or toolbox ruggedness, get a P.A.C.™ (Portable Add-In Computer).

■ **MASSIVE EXPANSION.** Nobody gives you more expansion possibilities than Dolch. In an 18 pound package a Dolch P.A.C. has room for up to five full-size EISA/ISA add-in cards. You can add up to 32 MB RAM, 1 GB HDD, and any combination of drives, CD-ROM, removable HD, streaming tape, and more. ■ **EXTREME POWER.** Dolch P.A.C. systems have been rated "the fastest portables on the market" since 1987, and have won more Editor's Choice awards than any other product in its category. *Computer Reseller News* calls the 486-50E "a dream machine . . . one of the most powerful PCs of any kind." P.A.C. systems are based on 386SX and DX, and 486 CPUs up to 50MHz, delivering as much as 22 MIPS. ■ **DAZZLING DISPLAYS.** "Breathtaking . . . Dolch's heart-stopping TFT Color Display produces vibrant colors and sharp images virtually on par with those seen on desktop VGA monitors," reports *PC Computing*. ■ **MIL RUGGEDNESS.** Every P.A.C. is as tough as it is powerful. Certified under MIL Std. 810C Dolch provides true mission critical reliability. ". . . it simply outclasses its competitors and it is sturdy and solid . . ." says *PC Magazine*. ■ **GET THE FULL STORY.** Call 1.800.995.7581. In Canada 1.800.561.4527.



POWER PORTABLE ADD-VANTAGE

DOLCH COMPUTER SYSTEMS • 372 TURQUOISE STREET • MILPITAS • CALIFORNIA 95035 • USA

Circle 101 on Inquiry Card.



1989



1989



1990



1990



1991



1991



1992



**IF IT HAS ADOBE<sup>\*</sup>  
SCALABLE FONTS,  
COLOR, AND  
QUIET TECHNOLOGY,  
IT CAN ONLY BE  
FROM PANASONIC.**

**Panasonic** 24 PIN  
*Quiet* KX-P2124  
Printing

Multi-Mode Printer

*The KX-P2124, a 24-pin with ATM<sup>\*</sup> and color option.*



A few dot-matrix printers offer you scalable fonts.

A few, color. But no other printer offers you scalable fonts...color...and Panasonic® Quiet Technology.

Put our KX-P2124 and 2123 to work and you'll get the flexibility of Adobe Type Manager® and scalable fonts...you'll add drama to your documents with our optional color kit...and you'll hear very little, indeed.

Put any of our other Quiet Technology printers to work and you can accomplish whatever your needs.

From our 2123, a budget-minded 24-pin with Adobe Type Manager\* and optional



color...to our 2624 wide-carriage business printer with ATM\*,...to our 9-pin 2180 with 6 near letter quality fonts and optional color.

All with the kind of features that made Panasonic printers the leaders of the industry. Such as multiple paper paths, EZ™ Set control panels, and a two-year limited warranty on parts and labor†.

The Panasonic 2000 Series Quiet Technology Printers.

Call us for more information: 1-800-742-8086. Or visit your Panasonic dealer.

†See your dealer for warranty details.

\* ATM and Adobe Type Manager are registered trademarks of Adobe. Adobe ATM for use with Microsoft® Windows™ 3.0 or higher. Available on selected printers only.



**ONCE YOU'VE TRIED OUR  
QUIET TECHNOLOGY PRINTERS,  
YOU'LL NEVER SETTLE FOR  
ANYTHING LESS.**



*The KX-P2123, a 24-pin with ATM\* and color option.*



*The KX-P2180, a 9-pin with color option. ATM\* not available.*



*The KX-P2624, a 24-pin with ATM\*. Color option not available.*

PQ9-BY

Circle 139 on Inquiry Card.



### Elegant PC Security

**T**he Firmloc access control system combines a smart electronic key and key receptacle with an internal microprocessor to prohibit unauthorized computer access. It recognizes authorized users when they insert a personal electronic key into the key receptacle, which is connected to the parallel port on the PC.

When a key is removed, the TSR software automatically locks the computer, immediately suspending the application that is running and blocking all routes into the system by blanking the screen and disabling the keyboard, the floppy drives, and the mouse. When the key is reinserted, the computer resumes operation where it left off. The software keeps an access record and records of invalid access attempts.

**Price:** \$249.95.

**Contact:** Intelligent Security Systems, Inc., P.O. Box 1133, Addison, TX 75001, (800) 237-4774 or (214) 869-3663.

**Circle 1286 on Inquiry Card.**



*Transparent to authorized users, Firmloc has an administrator and a user security level.*

### Listen to Your Computer with the CAT

**I**f you have a speaker on your PC, you can convert voice or sound messages into executable files with the CAT Sound Studio. You can transfer these files over a network, and the person receiving the files can listen to the message by typing the filename.

The CAT Sound Studio lets you edit messages and create special effects for Windows or DOS batch-file playback. You can merge voice and music with graphics and watch the sound patterns on the VU Meter and Histogram. The unit, which connects to the parallel port, includes a microphone, a parallel-port I/O audio interface, and sound-processing software.

**Price:** \$59.

**Contact:** Computer Aided Technology, Inc., 10132 Monroe Dr., Dallas, TX 75229, (214) 350-0888; fax (214) 904-0888.

**Circle 1289 on Inquiry Card.**



*The CAT Sound Studio offers more than 300 sound clips.*

### Touch Capability for Any Monitor

**V**isage's TouchMate input device works with any 12- to 19-inch computer monitor weighing up to 90 pounds without requiring the attachment of an additional screen or sensor. TouchMate fits underneath your monitor and plugs into your computer's serial port. Four sensors inside the unit accurately measure the location of a touch and the pressure exerted. TouchMate supports DOS, Windows, Unix, X Window System, and VMS.

**Price:** \$895.

**Contact:** Visage, Inc., 1881 Worcester Rd., Framingham, MA 01701, (508) 620-7100; fax (508) 620-0273.

**Circle 1288 on Inquiry Card.**

### Problem Solver

**T**he Programmable Protocol Converter allows incompatible hardware devices to communicate. The PPC-2 comes with two RS-232 ports with hardware, XON/XOFF handshakes, and modem control capability. For complex programming, a four-port device, the PPC-4, allows independent debugging while normal data I/O takes place on two or three other ports. You can leave the compact device in place as a stand-alone protocol converter once you finish your program.

The PPCs contain an integer BASIC interpreter and a standard Pascal compiler. The packages include an IBM PC ANSI emulator program with file transfer capabilities and an internal menu-driven EEPROM filing system that can store up to 20 user programs.

**Price:** PPC-2, about \$574 (£309); PPC-4, about \$707.50 (£378.50).

**Contact:** KK Systems Ltd., 36 Mill Hill Dr., Shoreham by Sea, West Sussex BN43 5TL, U.K., 44-273-452357; fax 44-273-440535.

**Circle 1287 on Inquiry Card.**

### Motorized Color Scanning

**A**t the heart of the Primax ColorMobile SC-424A hand scanner is a stepper motor that drives the scanner over your image in a straight line, eliminating stretched or uneven images caused by irregular hand movements. The scanner offers resolutions of up to 400 dpi in 16.8 million colors. For scanning a large image, the ColorMobile SC-424A uses a merge function and a TrackPad to ensure that the two halves of the image join exactly.

The ColorMobile SC-424A includes 64 KB, 256 KB, or 1 MB of buffer memory on the interface card; the TrackPad; iPhoto Plus image-enhancement software; and Interpreter OCR software.

**Price:** \$495 to \$595.

**Contact:** Primax Electronic, Ltd., Sixth Floor, No. 159, Kang Ning St., Hsi Chih Town, Taipei Hsien, Taiwan, 886-2-648-3073; fax 886-2-648-3064.

**Circle 1290 on Inquiry Card.**



# WATCOM SQL

## PC-based Client/Server SQL Tools

### Four Good Reasons to get your copy right away:

#### 1. True Client/Server for reliability and performance

Your databases are protected from corruption by features such as referential and entity integrity, as well as true transaction processing. Client/server architecture and our 32-bit database server software help deliver increased performance for applications running on your PC LANs.

#### 2. Royalty-free run-time

For just \$99 you get royalty-free run-time support. It lets you distribute applications for standalone PCs and include our single-user run-time database server. It also lets you distribute your applications on an unlimited number of client machines in network environments.

#### 3. Scalability

Whether you implement applications using the ACME front-end or write them in C or C++, they can be designed to run without change in environments ranging from standalone 640K single-user PCs to large networks running our

high-performance multi-user database server.

#### From entry level PCs...

You can use DOS PCs with just 640K memory as database server machines for small networks. For single-user standalone environments, the SQL database server together with an application can run on DOS PCs equipped with a minimum of 640K memory.

#### ...to high end servers.

The WATCOM SQL database server automatically adapts to utilize the available memory on your system for increased performance. The 32-bit version unleashes the power of 386/486 PC's to efficiently serve many clients in large networks.

#### 4. For a limited time it's yours for just \$395

WATCOM SQL Developer's Edition has a suggested retail price of \$795 but for a limited time you can get it at the introductory price of only \$395. Even better, as a registered user of the Developer's Edition you'll be able to get a copy of the 6-user Network Server Edition for only \$99 (Suggested retail price: \$795).

#### Developer's Edition

**Complete Client/Server Development Tools Package Including Standalone Single-user SQL Database Engine**

The Developer's Edition allows you to develop and deploy single-user standalone applications, and to develop applications for use with the WATCOM SQL Network Server Edition. You get the **ACME (Application Creation Made Easy)** front-end application development system. It combines visual forms design with simple event-driven programming to allow rapid prototyping and development of client applications without C programming. The Developer's Edition also includes IBM SAA standard embedded SQL support for C/C++ application development with WATCOM, Microsoft and Borland compilers.

**Package components include:** Single-user standalone database server (both 16 and 32-bit versions) • Interactive SQL • ACME front-end application development system • Embedded SQL/C preprocessor • SQL libraries for use with WATCOM C, WATCOM C/386, Microsoft C/C++, and Borland C/C++.

#### System Requirements:

**Hardware:** IBM PC compatible with hard disk, 640K minimum memory

**Software:** DOS, Windows DOS box, or OS/2 DOS box

**Special Introductory Offer: \$395** (Suggested retail price: \$795)

**Special offers available to registered users:** (details inside package)

- **Royalty-free run-time support:** \$99

- **6-user Network Server Edition:** \$99 (Suggested retail price: \$795)

#### Network Server Edition

**High-performance Multi-user SQL Database Server for PC LANs**

The Network Server Edition provides client/server support for multiple concurrent users in a local area network environment. The WATCOM SQL database server supports ANSI standard SQL and provides advanced capabilities, including bi-directional scrollable updatable cursors, referential integrity, row-level locking and symmetric multiprocessing of requests. WATCOM SQL also gives you comprehensive security capabilities, data encryption and data compression. Compatible programming interfaces let you implement applications that run without change using either the standalone single-user database or the Network Server Edition.

**Package components include:** Multi-user network database server (both 16 and 32-bit versions) • Interactive SQL • Network requestor and request manager.

#### Client System Requirements:

**Hardware:** IBM PC compatibles, 640K minimum memory

**Software:** DOS, Windows DOS box, or OS/2 DOS box

#### Database Server System Requirements:

**Hardware:** IBM PC compatible with hard disk, 640K minimum memory

**Software:** DOS

**Network Requirements:** NetBIOS or Novell Network (IPX)

**Suggested Retail Price:** 6-user version: \$795  
Unlimited version: \$1,595

WATCOM, 415 Phillip Street, Waterloo, Ontario, Canada N2L 3X2

Telephone: (519) 886-3700, Fax: (519) 747-4971

Prices do not include freight and taxes where applicable. Authorized dealers may sell for less. WATCOM SQL, the Lightning Device, and Application Creation Made Easy are trademarks of WATCOM International Corporation. Other trademarks are the properties of their respective owners. Copyright 1992 WATCOM International Corporation.

## WATCOM

## 1-800-265-4555

### The Leader in Development Tools

Circle 191 on Inquiry Card.





Pick your power! 486SX-25 thru the 486DX2-66. And upgrading is easy with our Zero Insertion Force (ZIF) socket. Note the extra row of pins for the future P24T!

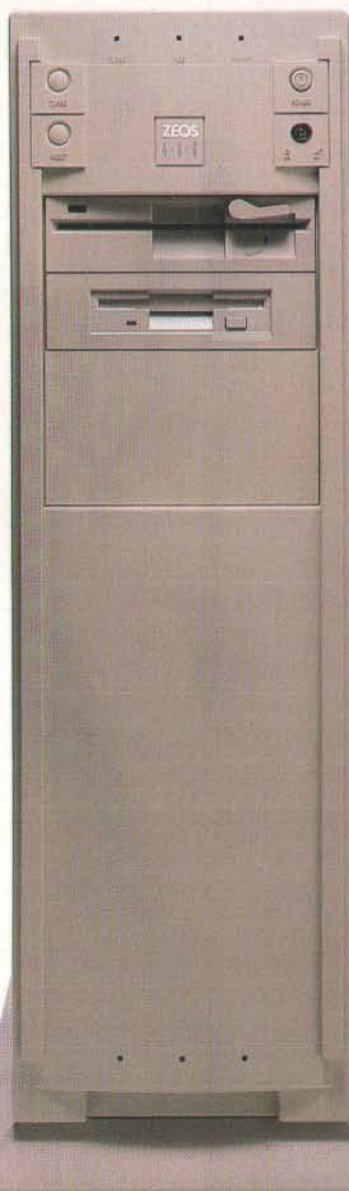


The on-board SCSI option lets you add SCSI I or II devices anytime. SCSI hard drives, opticals and more are easy to add.



When you buy any ZEOS Windows system you can choose 2 of 3 Windows applications: Lotus 1-2-3 for Windows, Ami Pro and Freelance Graphics for Windows!

# ZEOS® Gives You More.



*You simply get more. For less.* When everyone else started cutting prices by giving less, ZEOS had a better idea—Use the very latest technology to design an entirely new line of high performance upgradables that allow us to *charge less while giving more.* You're going to love it!

## ZEOS. THE UPGRADABLE EXPERTS.

Nobody knows upgradability better than ZEOS. After all, ZEOS was one of the first to introduce truly high-performance upgradable PCs. Now using the latest in high-integration technology we've made a good thing even better, right up to the 486DX2-66 and beyond.

How far beyond?

Try the P24T! Start today with the 486 CPU of your choice. Select between the 486SX-25 or 33, the 486DX-33, the 486DX2-50 or the 486DX2-66. Then, in 1993, you'll be able to add the new P24T super processor (you'll note the extra row of pins around each side of your CPU upgrade socket, that's what they're for). Maximum power today *and* tomorrow.

*Consider the Vertical Option. We can build your new upgradable system in our eight-bay vertical case. It comes complete with our high-capacity power supply and two cooling fans. Add only \$95.*

## TWO VESA STANDARD LOCAL BUS SLOTS.

While the others are talking about local bus, often creating their own non-standard solutions, ZEOS gives you a VESA future. As a working member of the VESA Standards Committee, ZEOS has incorporated *two* slots conforming to the recently established VESA standard.

What does this mean to you?

Unparalleled VESA local bus performance! We've taken one of your two VESA local bus slots (which can also be used for standard 16-bit cards if you wish) and added a *screaming* local bus video card. Windows has never moved so fast! And with our bus mastering capability, a second local bus card can be added in the future as well. ZEOS gives you more performance options than anyone else. *Take a closer look!*

## PEAK PERFORMANCE. A ZEOS STANDARD.

With ZEOS, performance enhancements are standard. If you have a technical bent you'll love reading about them. If you're a typical user, just tell your friends your new ZEOS system has these things. They'll be impressed. Like what?







You can upgrade your system now or in the future with our optional 128K or 256K secondary cache modules.



ZEOS systems feature award-winning reliability and support. Nine times PC Magazine's Editors' Choice.

Mention your new system has FLASH BIOS for easy BIOS upgrades via disk or modem. Also mention your true 80486 VLSI chip set with burst mode memory support, talk about your high-speed memory expandable to 64MB. Mention your fast IDE HDD controller and your hard drive with its own built-in cache. Then talk about the other ZEOS performance options. Like your upgradable high-speed cache!

### THE CACHE OPTION IS YOURS.

Because painfully missing from many competitors offerings is the option for a secondary cache. With ZEOS you can add a secondary cache of 128K or 256K. This speeds up many memory intensive applications. Take it now or add it later if you wish. ZEOS gives you the option. And that's just for starters.

### ON-BOARD SCSI IF YOU WISH!

Because your new ZEOS upgradable offers you the additional option of on-board SCSI. By simply adding a single socketed SCSI chip to the board your new ZEOS system supports both SCSI I and SCSI II type devices. You can now have SCSI hard drives (running in addition to your standard IDE drives) plus tape backups, optical drives and a host of other SCSI peripherals. Take it now or add it later. Only from ZEOS.

### MORE FEATURES. MORE BENEFITS.

Like the two cooling fans you'll find in every ZEOS system. While ZEOS systems run cooler than most with one fan we still give you *two whisper-quiet cooling fans*. The cooler your system runs the longer it will last. We also include a built-in surge suppressor in every system. These are extra features the others *can't* or *won't* offer you. From ZEOS, they're yours. No additional charge.

### FREE LOTUS SOFTWARE TOO!

And don't forget, when you purchase any new ZEOS Windows-based system, you will also receive your choice of two:

*Lotus 1-2-3 for Windows*, *Ami Pro*, and *Freelance Graphics*. The software alone carries a suggested retail price of over \$1,000 and we're giving it to you absolutely free. Now that's ZEOS Value.

### 24-HOUR-A-DAY SUPPORT. AND MORE!

Remember too, ZEOS provides you with our top-rated 24-Hour-a-Day Toll-Free Technical Support. *Plus* your new ZEOS system is covered by our 30-Day Money-Back Guarantee, One Full Year Limited Warranty, and our Express Parts Replacement Policy.

### CALL NOW TOLL FREE.

# 800-423-5891

Ordering your new ZEOS upgradable system is easy. Simply pick up the phone and give us a call. A friendly and knowledgeable ZEOS Systems Consultant is ready to answer any questions you may have. You're going to love your new ZEOS system.

*Why not give us a call right now!*

Purchase orders from Fortune 1000 companies, governments and institutions subject to approval. Leasing programs are available. All prices and specifications are subject to change without notice. Please call to confirm pricing, specifications and warranty details. The following are trademarks of their respective companies: ZEOS (ZEOS International, Ltd.). ©1992, ZEOS International, Ltd., 530 5th Avenue N.W., St. Paul, MN 55112 USA. ZEOS is a publicly traded company (NASDAQ symbol: ZEOS). UPRG-BYT-9210

### PICK YOUR POWER.

Or we can custom-build a system to your exact specifications!

- Your choice of CPU with upgrade options to the future P24T.
- 8MB of RAM expandable to 64.
- A full 245MB high-speed IDE hard drive with built-in cache.
- Both 1.2 and 1.44 Teac® FDD.
- ZEOS 14" Hi-Res 1024x768 non-interlaced VGA color monitor with 1MB high-speed VESA Local Bus card.
- Two serial and one bi-directional enhanced parallel port.
- Shadow RAM/EMS support.
- Optional SCSI port (plug-in chip) for SCSI I & II devices.
- Upgradable high-speed cache options of 128K and 256K.
- Flash BIOS for easy BIOS upgrades.
- High-capacity power supply with built-in surge suppression.
- Rugged ZEOS SpaceSaver case with seven drive bays and two cooling fans.
- ZEOS RS/101-key keyboard.
- Microsoft DOS, Windows and a genuine Microsoft Mouse, plus your choice of two Lotus applications for Windows!
- ZEOS 24-Hour-a-Day Toll-Free Technical Support and complete Customer Satisfaction Package.

486SX-25	\$2295
486SX-33	\$2495
486DX-33	\$2695
486DX2-50	\$2895
486DX2-66	\$3095

### ORDER NOW TOLL FREE 800-423-5891

Fax Orders: 612-633-1325  
Government: 800-245-2449  
TDD Orders: 800-228-5389  
Outside U.S. and Canada:  
612-633-6131  
MasterCard, VISA, Am Exp,  
Discover, Z-Card,™ COD  
and Leasing Programs.  
Open 24 Hours a Day,  
365 Days a Year!





### Power Protection for Your LAN

**T**he LanGarde UPSes, ranging from 400 VA to 1250 VA, meet both the UL1778 UPS rating and the UL1449 rating for transient-voltage surge suppression. The MouseTrax remote system in the units provides remote monitoring and tracking of the AC power and the unit itself. A removable display-and-control front panel fits on your desk, where it's easy to see without having the unit take up desktop space.

Other features include EasyChange battery replacement; the SpikeLog Surge Monitor, which reports when a surge activates the protection circuitry; and the Net-Trax Windows software, which controls, monitors, and analyzes power by taking snapshots of events or at periodic intervals. The units also include a dynamic battery-monitoring system and an interface system that permits network power management of units such as hubs and printers.

**Price:** \$499.95 and up.  
**Contact:** EFI Electronics Corp., 2415 South 2300 West, Salt Lake City, UT 84119, (800) 877-1174 or (801) 977-9009; fax (801) 977-0200.

**Circle 1291 on Inquiry Card.**

### Take a Peek at Your Network

**A** troubleshooting tool for network managers, TokenPeek captures and decodes network traffic in any mixed-platform token-ring environment. The Mac-based network analyzer turns any connected Mac into a passive



*You can cascade multiple LanGarde UPSes from a single serial port, creating a local UPS network.*

tap that uses the token-ring interface card to capture all network traffic for real-time and post-capture analysis.

TokenPeek displays network baseline data in bar-graph form, allowing a manager to explore packet traffic to the bit level when searching for the source of problems. The tool decodes packets so that protocol layers and data appear in straightforward text. Able to generate token-ring traffic, TokenPeek is also useful for network configuration testing.

**Price:** \$995.  
**Contact:** The AG Group, Inc., 2540 Camino Diablo, Suite 202, Walnut Creek, CA 94596, (510) 937-7900; fax (510) 937-2479.

**Circle 1292 on Inquiry Card.**

### Multiple Modems

**A**ble to operate for up to 12 hours on a set of four AA batteries, the Omron Impala 24/96 portable fax modem for Windows and DOS includes a power saver that puts the modem into sleep



mode when the unit is offline and the PC-to-fax interface is idle. The Class 2 device, which supports the Hayes extended AT command set, has V.42bis and MNP 5 data compression; it includes V.42 and MNP 2 through MNP 4 error correction. A Mac version is also available.

**Price:** \$399.  
**Contact:** Omron Office Automation Products, Inc., 3945 Freedom Cir., Suite 400, Santa Clara, CA 95054, (408) 727-1444; fax (408) 970-1149.

**Circle 1293 on Inquiry Card.**

**T**he Smart One 1442F internal and 1442FX external fax modems incorporate V.42bis and MNP error



correction and data compression for 57,600-bps throughput. Including time-scheduled transmission, multiple-file broadcasting, and polling capabilities, the modems can also view, rotate, and print incoming faxes. The external version is available for Windows, DOS, and the Mac.

**Price:** 1442F, \$399; 1442FX, \$499.

**Contact:** Best Data Products, Inc., 9304 Deering Ave., Chatsworth, CA 91311, (818) 773-9600.

**Circle 1294 on Inquiry Card.**

**T**he UltraLite 14.4 data/fax modem from NEC Technologies supports V.32bis for data transmission speeds of up to 38,400 bps and fax send/receive speeds of 9600 bps. Compatible with the company's UltraLite SL/20, SL/20P, and SL/25C notebook computers, the modem includes cellular capability, data encryption, flash ROM, MNP level 4 or V.42-compliant error protection, and MNP 5 or V.42bis data compression.

**Price:** \$699.  
**Contact:** NEC Technologies, Inc., 1414 Massachusetts Ave., Boxborough, MA 01719, (508) 264-8000.

**Circle 1319 on Inquiry Card.**

### Pocket Parallel-Port Print Servers

**T**wo new Pocket Print Servers attach to your printer's parallel port to speed up printing on NetWare networks. The ESI-2829A model supports 10Base-2 (thin coaxial) Ethernet, and the ESI-2848A model supports nine-pin token-ring connections. Supporting NetWare 2.15 or higher and NetWare 386, the Pocket Print Server parallel interface transfers data in large blocks at speeds of up to 50 KBps.

**Price:** ESI-2829A, \$495; ESI-2848A, \$995.  
**Contact:** Extended Systems, 6123 North Meeker Ave., Boise, ID 83704, (800) 235-7576 or (406) 587-7575.

**Circle 1295 on Inquiry Card.**



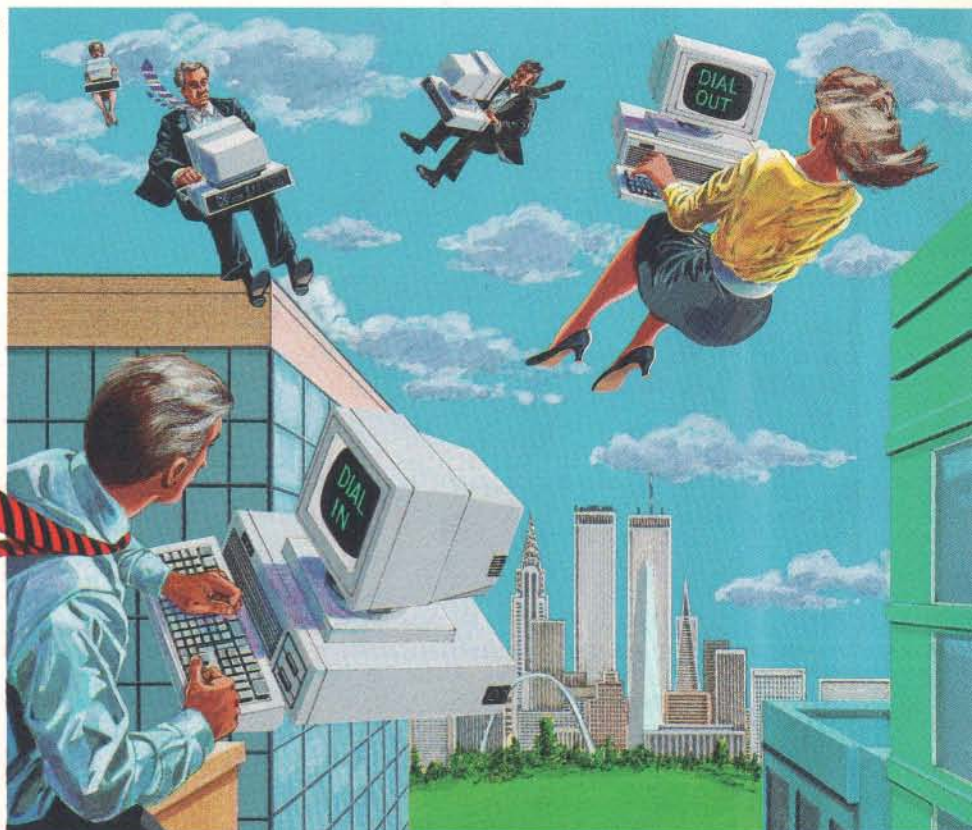
# IT OPENS UP SOME REMOTE POSSIBILITIES.

The problem with local area networks is that they're too local. People fly, ride, travel and go places. LANs don't. Or at least they didn't, until now. ⚡ With Microtest's LANMODEM, authorized users can call in from any location in the world and access their Novell networks without the typical dial-in complexity. Same for network managers performing remote support. ⚡ LANMODEM is a high-speed, network attachable modem that also acts as a communications server. So it opens up possibilities that you've never had before—in one integrated solution. ⚡ One easy-to-install box allows entire workgroups to share high-speed modems, not only for dialing into the network, but also for dialing out to electronic information services or other LANs.

Any combination of these applications are

LANMODEM includes a V.32bis/V.42bis internal modem.

possible simultaneously, when a second modem is attached to LANMODEM's external



serial port. ⚡ While users enjoy easier network access, LAN administrators will appreciate LANMODEM, too. Its innovative hardware/software design and group set-up capabilities make LANMODEM easy to install and manage. Plus, LANMODEM's advanced security features protect the LAN from unauthorized access. ⚡ To find out how LANMODEM can open up some remote possibilities for your network,

**MICROTEST®** call Microtest at **800-526-9675.**



90W psu (150W on B-series), unique mains/standby power switch combination

Choice of Slimline M or Compact B case

Choice of interlaced and non-interlaced, low radiation, MPR II colour SVGA or mono VGA monitor

Keyboard, mouse, MS-DOS 5.0, Windows 3.1

#### Universal Motherboard

2MB RAM (max 32MB) for 486SX CPUs  
4MB RAM (max 32MB) for 486DX CPUs  
VGA 512k upgradeable to 1MB Video RAM advanced graphics connector, 1 parallel 2 serial ports

#### Processor Cards

PC-466: 66MHz 486DX2, 64k cache (max 1MB)

PC-450: 50MHz 486DX2, 64k cache (max 1MB)

PC-433: 33MHz 486DX, 64k cache (max 1MB)

PC-425X: 25MHz 486SX, 64 cache (max 1 MB)

PC-420X: 20MHz 486SX, 8k internal cache

#### WAC 92 Windows Accelerator Card

S3-based windows accelerator, VGA compatible, up to 1280 x 1024 pixels, 1MB Video Ram, 256 from a palette of 262,000 colours

#### Advanced Colour Monitors

1280 x 1024 pixels, interlaced and non-interlaced, XV17: 17", XV20: 20" Trinitron.

#### Sample Colour Price

**NEW POWER OPTION**  
**PC-466M**

4MB RAM, 66MHz, 486 DX2

**£ 1 6 9 5**

512k Video RAM	Colour VGA	S3 VGA Windows Accelerator
Monitor	SVGA	XV17 XV17 XV20
PC-466M	£1,695	£2,180 £2,350 £3,100
PC-450M	£1,395	£1,880 £2,050 £2,800
PC-433M	£1,175	£1,660 £1,830 £2,580
PC-425XM	£895	£1,380 £1,550 £2,300
PC-420XM	£795	£1,280 £1,450 £2,200

90W psu (150W on B-series), unique mains / standby power switch combination.  
For B model ADD £40

#### Hard Disk options

100MB ide	Add £70	400MB scsi	Add £865
200MB ide	Add £280	1.0 GB scsi	Add £1,465
400MB ide	Add £650	1.4 GB scsi	Add £1,965

Each Elonex PC comes ready to use with MS-DOS and Windows 3.1 installed and is backed up by our Technical Support Hotline (081-452 6666)

Response Computer Maintenance (081-965 3225) provide the first year's on-site maintenance free of charge, with subsequent years priced at 8% of the original invoice (min. £75).

Elonex is a registered trade mark of Elonex plc. MS-DOS and Windows are trademarks of Microsoft Inc. The Intel Inside logo, and the Intel486™ are trademarks of Intel Corporation.

All prices and specifications are subject to change without notice.

Elonex plc, 2 Apsley Way, London NW2 7LF  
**Tel 081-452 4444**  
Fax: 081-452 6422

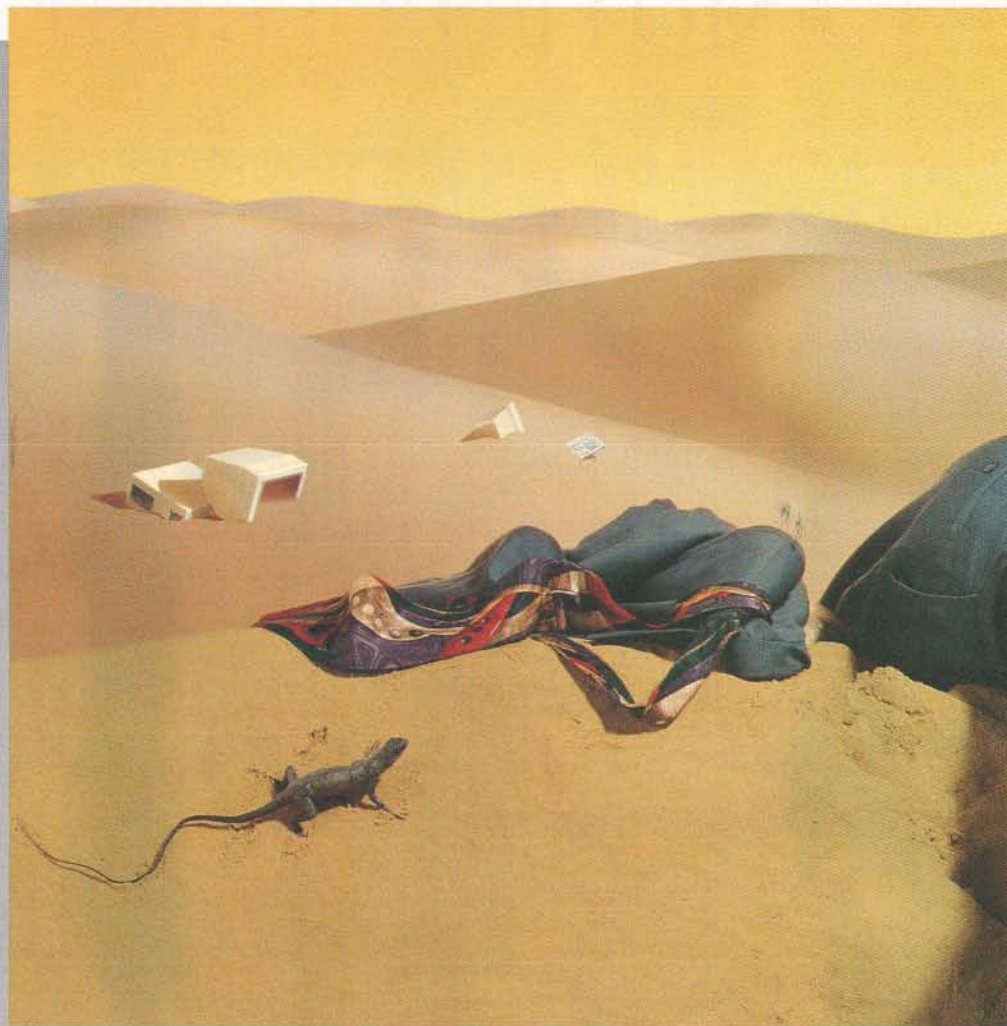
Elonex plc, 7-9 Campus Road, Listerhills Science Park, Bradford BD7 1HR.  
**Tel 0274-307226**  
Fax: 0274-307294

Elonex (France) s.a.r.l., Paris, France  
Tel (1) 40.85.85.40 Fax (1)40.85.84.83

Elonex (Benelux) sa/nv, Brussels, Belgium  
Tel (02) 675.19.20 Fax (02) 675.34.00

ERS Computers, Dublin, Eire  
Tel 01-6797554 Fax 01-6791728

# ELONEXH



Who else but Elonex could bring you a PC to satisfy your thirst for computing power without scorching your bank balance.

High quality PC's, all upgradeable from a 20MHz 486SX, to an amazing 66MHz, at prices which other manufacturers will find hard to match.

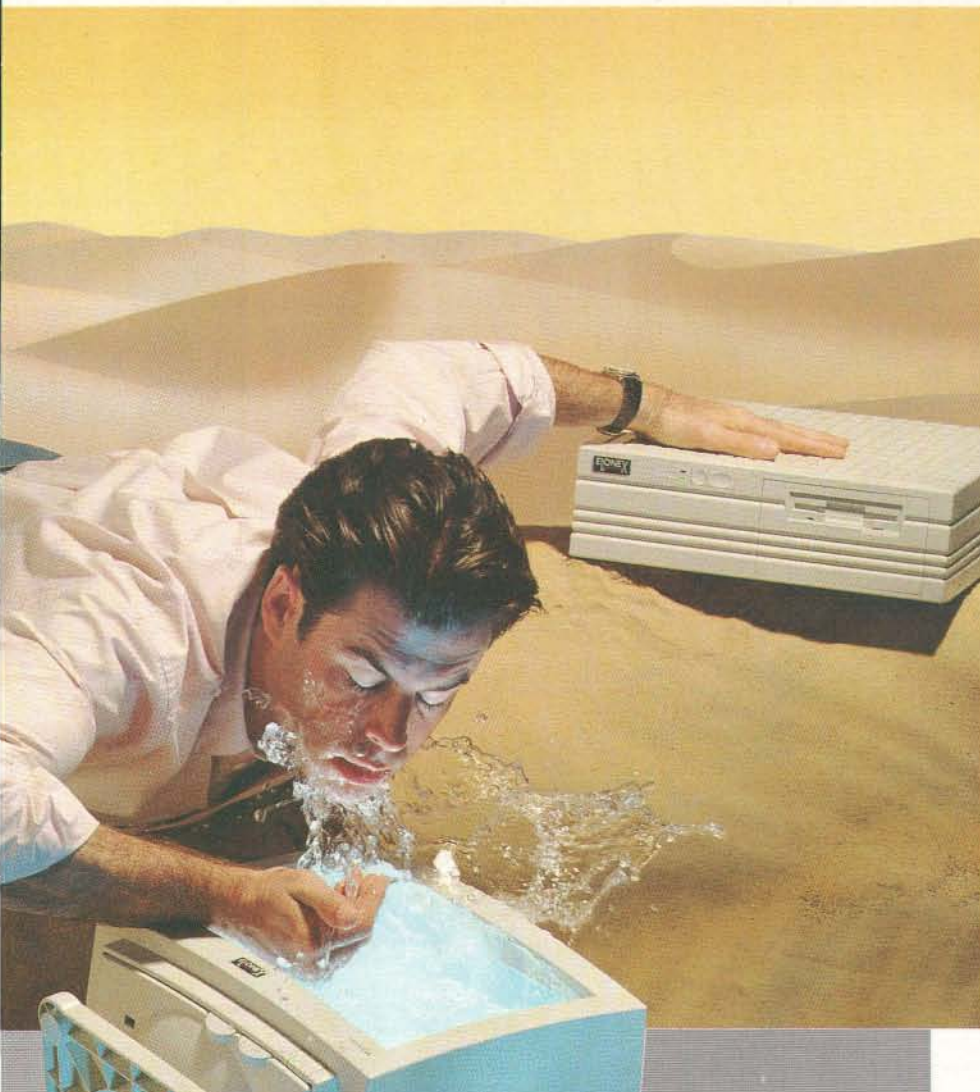
Our British-made PC's are built to the highest standards and supported by an after sales service that includes FREE on-site maintenance for the first year.

Quality, choice and value for money have made Elonex the U.K.'s leading direct PC seller.

Quench your thirst, call Elonex now on 081 452 4444.



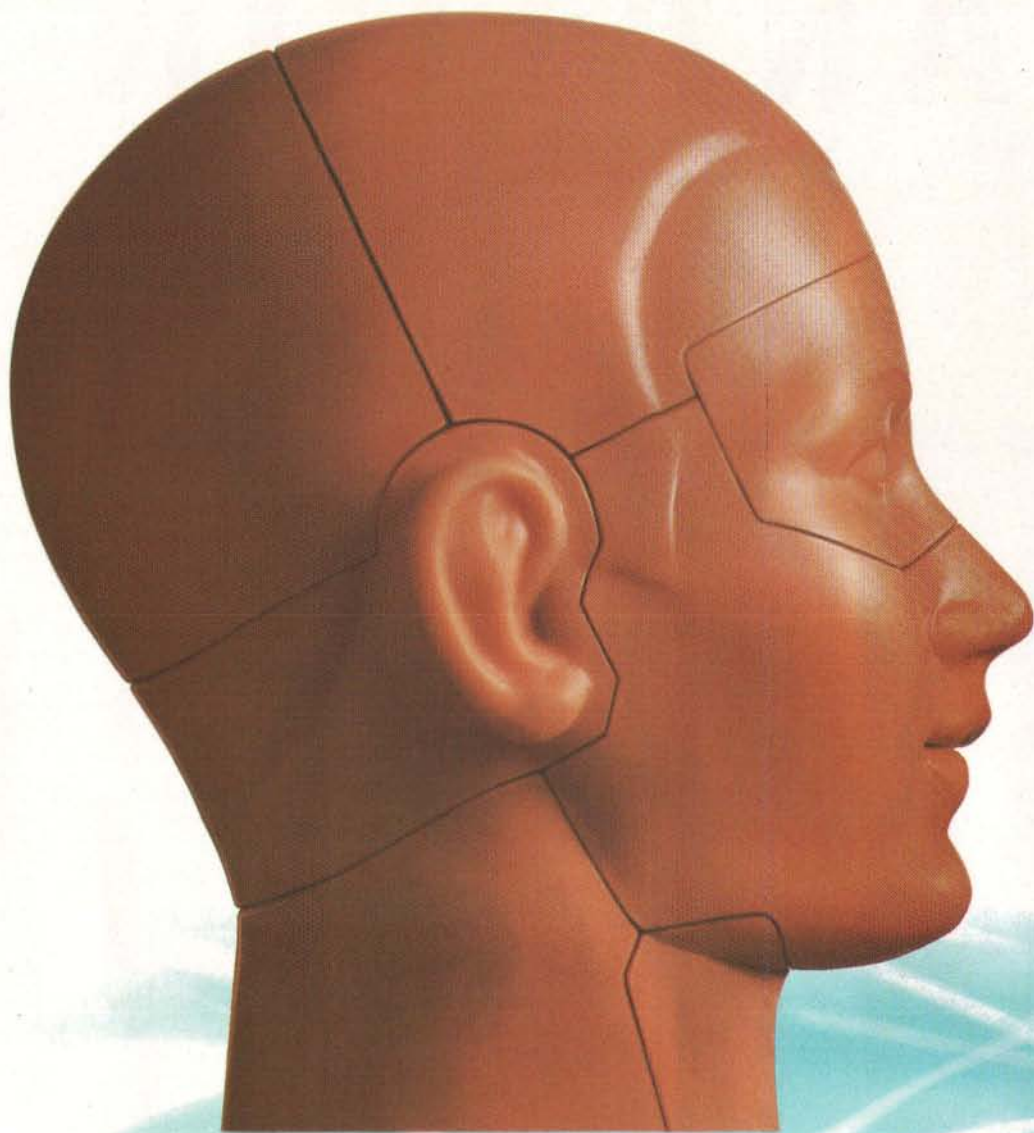
# ELONEX



**ELONEX**

**PERSONAL  
COMPUTERS**





# Brilliant minds n

**Epecially with the new 17" Brilliance 1710,** high-resolution, low-emission MPR-II monitor. It gives the clearest, most relaxing view of your windows, DTP and graphics applications.

**With resolutions up to 1280 x 1024** even the finest details are crystal clear. The Black Matrix tube with flat, square screen delivers high contrast and no distortion.

**High refresh rates,** for example 75 Hz in the 1024 x 768 mode,

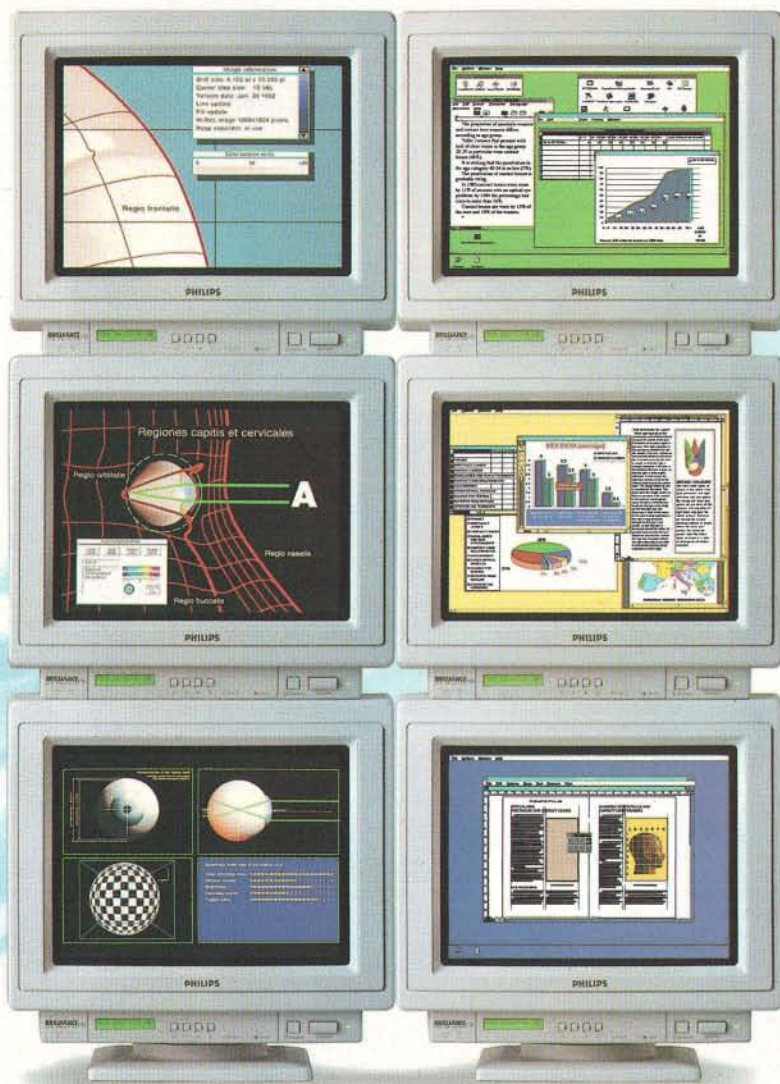
ensure both high-resolution and flicker-free image stability.

**Digital control** makes it easy to switch between 26 pre-set user-programable display modes, without having to set the adjustments. The front panel LCD display clearly shows status and settings.

**With Autoscan for multi-compatibility,** the Brilliance 1710 matches your PC, workstation or Macintosh perfectly and handles virtually all today's high-resolution video cards.







Brilliance is a registered trademark of Philips Electronics N.V. Windows is a trademark of Microsoft Corp. Macintosh is a registered trademark of Apple Computer Inc.

# Now see even better.

***There is a complete range of Brilliance monitors,*** from  
 " Super VGA for everyday business use, to 21" with resolutions up  
 to 1600 x 1280 for demanding professional applications.

For brilliant support, and more information, contact:

Philips Monitors, SFF-7, PO Box 80002

5600 JB Eindhoven, The Netherlands, fax +31 40 733983

**BRILLIANCE<sup>®</sup>**  
**HIGH RESOLUTION MONITORS**

**PHILIPS**

Circle 393 on Inquiry Card.



### Voice, Fax, and Data

**T**he Ultima Home Office/PC add-in card provides voice-mail, data-modem, and send/receive fax capabilities for your desktop or portable PC. With a V.32bis modem, the card can transmit at speeds of up to 14,400 bps. The card also has MNP level 5 and V.42bis automatic error correction and data compression, enabling it to determine the speed of another modem and connect at that modem's highest speed within the range of 300 to 14,400 bps.

Maxfax, an integrated software application for fax and voice mail, operates as a DOS and Windows application. The card lets you convert ASCII, PCX, TIFF, and IMG files to fax format, and its preview mode lets you view as many as 10 fax images at once. The voice portion runs as a DOS TSR program; you go into Windows to play messages and record faxes. Line sharing enables you to connect to a standard telephone line to accept voice, fax, and data calls.

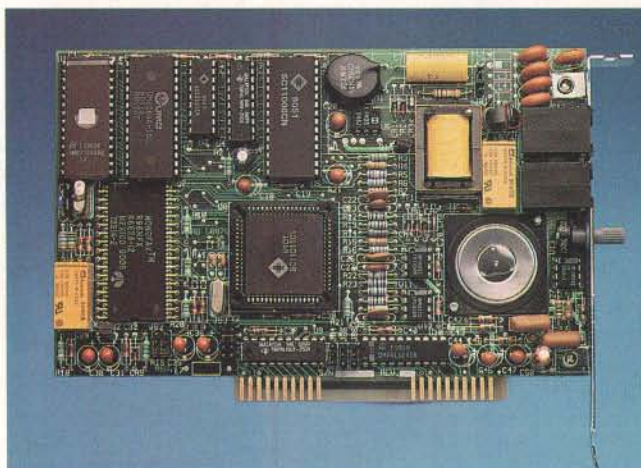
**Price:** \$539.

**Contact:** Prometheus Products, Inc., 9524 Southwest Tualatin Sherwood Rd., Tualatin, OR 97062, (800) 477-3473 or (503) 692-9600; fax (503) 691-1101.

**Circle 1296 on Inquiry Card.**

### Cordless Modem

**T**he Scarab 9600 Cordless Modem uses a UHF RF modulation transmission technique to connect communications devices at distances of from 50 to 200 yards. You connect the modem to your PC's serial port using the supplied three-way serial-port cable. The relocatable head



*Voice mail in the Ultima Home Office/PC lets you identify mailboxes to which you can forward urgent messages.*

unit and range-test facility lets you determine unexpected areas of radio window, maintain optimal reception and siting at range, and escape areas of radio shadow.

The Scarab Program can run in the background and pop up between communications tasks and interface to foreground DOS applications. The package also includes Datasoft's Datatalk4 modem software. You can also program the Scarab 9600 as a multifunction messaging and error-protected multifile transfer system or as a serial-port sharer and multiplexer for communications equipment such as fax modems.

**Price:** About \$540 (£301).

**Contact:** New Era Microsystems Ltd., 24 Cargate Ave., Aldershot, Hampshire GU11 3EW, U.K., 44-252-345426; fax 44-252-317699.

**Circle 1297 on Inquiry Card.**

### Remote Control in Windows

**T**he Windows-based remote-control and communications application Remotely Possible/Dial 2.0 uses a Windows DLL to interact with the Windows 3.x GDI (Graphics Device Interface)

library. In addition to allowing full access to a remote PC running Windows, the dial-up software includes file transfer and interactive chat between two PCs that are running Windows.

With support for serial-port speeds as high as 115,200 bps, Remotely Possible/Dial 2.0 is compatible with the Codex 3261 V.Fast modem, as well as V.32 and V.32bis modems. The new version also supports Super VGA displays of up to 1024- by 768-pixel resolution with 256 colors, as well as Windows accelerator cards. A single copy supports the local and remote PCs. Site licenses are available.

**Price:** \$199.

**Contact:** Avalan Technology, Inc., 116 Hopping Brook Park, Holliston, MA 01746, (800) 441-2281 or (508) 429-6482; fax (508) 429-3179.

**Circle 1298 on Inquiry Card.**

### Peer-to-Peer Networking

Two systems offer different approaches to building a peer-to-peer LAN. One con-

centrates on small networks; the other has larger aspirations.

**T**he MosesAll peer-to-peer network operating system lets you network up to eight computers, which can share applications and data, print files, and run Windows from any Windows-compatible PC on the network. MosesAll comes with a 2-Mbps network card, a copy of Moses-NOS 3.0 network operating software, and 25 feet of standard telephone wire. The expandable system supports operations at up to 500 feet per node via standard unshielded twisted-pair cable.

**Price:** \$99 per node.

**Contact:** Moses Computers, 15466 Los Gatos Blvd., Suite 201, Los Gatos, CA 95032, (408) 358-1550.

**Circle 1299 on Inquiry Card.**

**A**vailable for up to 200 PCs, the Let's Talk Modular Networking System lets you transfer files from one computer to another, send messages to others on the network, and access any networked printer from any networked computer. You can exchange messages with other people on the network without interrupting your current application. The Chat feature lets you type in messages on one side of a double window while receiving responses on the other side.

To install Let's Talk, you plug a small interface module into the parallel port of the PC. Any printer connected to the port remains operative. Computers are linked via a daisy chain of modular telephone cord.

**Price:** Two-computer starter kit, \$279.95; expansion kit, \$139.95.

**Contact:** Data Spec, 9410 Owensmouth Ave., Chatsworth, CA 91311, (818) 772-9977.

**Circle 1300 on Inquiry Card.**





# Thirteen reviewed. One winner.

IN REVIEW AFTER REVIEW, Jumbo takes top honors. PC Magazine's *exclusive* Editors' Choice is the 12th award in the last year. Which proves Jumbo is a backup value that can't be beat. Jumbo gives you top performance, yet it's easy to use. Choose either Jumbo 120 (120 MB with data

compression) or Jumbo 250 (250 MB with data compression). Both give you QIC compatibility, Novell® Certification and UNIX®/Xenix® support.

Call 1-800-451-0897, ext. 163 today for a free brochure.



Jumbo 120  
\$250

Jumbo 250  
\$350

**COLORADO™  
MEMORY SYSTEMS**  
800 S. Taft Ave., Loveland, CO 80537

Novell, UNIX and Xenix are registered trademarks of their respective companies. © 1992 Colorado Memory Systems, Inc. All rights reserved.

**Circle 83 on Inquiry Card (RESELLERS: 84).**

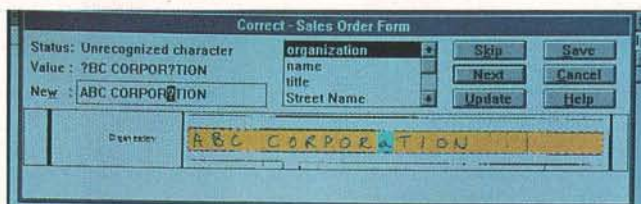


### Build Fax-Driven Programs for Windows

**T**PKD (Teleform Programmer's Developer Toolkit) lets you build fax-driven action into your Windows applications. The toolkit contains Cardiff Software's Teleform fax-processing program and a data interpretation library, TIE (Teleform Interpretation Engine). Teleform is Windows-based fax-processing software that lets you distribute custom-designed forms and collect filled-in forms via fax. You can also collect form-based data from sources such as scanned documents or fax servers.

Teleform processes the contents of collected image files via shaded circles or intelligent character recognition and stores the data. TIE is a DLL that interprets the collected data and performs a specific action (e.g., route, store, format, or execute data in real time) indicated by the information gathered.

TPDK runs under Windows and is written in C. According to the developer, it will work with any fax board,



*TPDK flags suspicious characters to ensure that your applications collect useful data.*

network, fax server, or scanner. A multiuser version lets you process multiple incoming faxes simultaneously. **Price:** TPDK, \$1495; multiuser version, price depends on configuration. **Contact:** Cardiff Software, 531 Stevens Ave., Building B, Solana Beach, CA 92075, (800) 659-8755 or (619) 259-6430; fax (619) 259-6450. **Circle 1304 on Inquiry Card.**

### Generate Portable Windows Code

**C**ross-platform portability is one of many new features built into version 4.0 of the WMP (WindowsMaker Professional) Windows application builder and C/C++ compiler. Using interchangeable code-generation modules, you can design your application once and then generate code for ANSI C, Borland OWL C++, Windows NT,

OS/2, Turbo Pascal, and other languages and platforms.

WMP generates both framework and interface code. The system provides often-used GUI elements (e.g., menus, scroll bars, and dialog boxes) in a toolbar, so you can make your most common selections from a main window. The WMP simulation mode lets you test your Windows interfaces before generating code.

WMP ships with the ANSI C code-generation module. There are no run-time fees or royalties associated with distribution of WMP-based programs.

**Price:** WindowsMaker Professional 4.0, \$995; additional code-generation modules, \$495 each. **Contact:** Blue Sky Software Corp., 7486 La Jolla Blvd., Suite 3, La Jolla, CA 92037, (800) 677-4946 or (619) 459-6365; fax (619) 459-6366. **Circle 1301 on Inquiry Card.**

### Windows OOP Originator Upgrades

**T**he latest Windows release of the Smalltalk/V OOP (object-oriented programming) tool provides traditional Smalltalk/V features (e.g., source code browsers and push-button debuggers) while offering support for Windows 3.1-based features. New to version 2.0 are DDE and DLL support. The system

also includes a configurable panel of push-button programming functions, an application status window, and support for non-U.S. character sets.

According to Digitalk, Smalltalk/V Windows source code is compatible with code generated in the Smalltalk/V OS/2 environment.

**Price:** \$499.95. **Contact:** Digitalk, Inc., 9841 Airport Blvd., Los Angeles, CA 90045, (310) 645-1082; fax (310) 645-1306. **Circle 1302 on Inquiry Card.**

### Portable GUIs from XVT

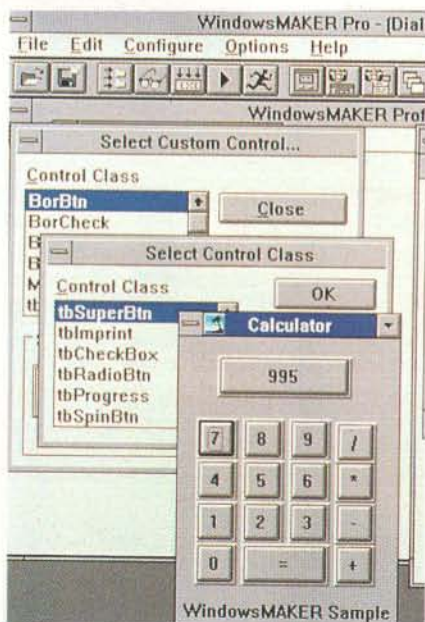
**A** pair of programming tools from XVT Software let you design and build a program that will run on six different GUIs and over 26 platforms without rewriting code. To use version 3.0 of the royalty-free XVT Portability Toolkit, you write your application in C or C++ and use the XVT API calls to create and manipulate the interface. Supported GUIs include Windows, Presentation Manager, Macintosh, Motif, Open Look, and character displays.

XVT-Design 1.1 lets you graphically design and manipulate all controls and attributes available in the Portability Toolkit. XVT-Design generates ANSI C GUI code, C header files, make files, and Universal Resource Language files that are compatible with the Portability Toolkit.

**Price:** XVT Portability Toolkit 3.0, \$1450 to \$4400; XVT-Design 1.1, \$1200 to \$2900.

**Contact:** XVT Software, Inc., 4900 Pearl East Cir., Boulder, CO 80308, (303) 443-4223; fax (303) 443-0969.

**Circle 1303 on Inquiry Card.**



*WindowsMaker Professional provides the visual elements of a Windows user interface as ready-made objects.*



# Raima Database Engine Captures Fortune 500 With Record Speed



**Now Raima Data Manager™**  
*Formerly db\_VISTA III*

## Accelerated Database Performance

Compared to conventional relational databases, retrieval of records can be 10—20—even 50 times faster with Raima Data Manager from Raima Corporation.

## Propelling The Biggest Names In Business

Companies like General Motors, Hewlett-Packard, IBM, Eastman Kodak, Rockwell and others are using Raima Data Manager in their competitive environments. Today's most critical, most demanding applications demand the high performance of Raima Data Manager.

## Powerfully Efficient Leading-Edge Technology

Raima's combined technology merges the flexibility of relational databases with the lightning speed and efficient

storage of the network model. With the program written entirely in C, you can "fine-tune" the Raima Data Manager engine for optimum performance in any application.

## Put Yourself In Fast Company

Give yourself the competitive edge of Raima Data Manager:

- Speed—faster access to data
- Portability—supports most environments
- Royalty-free—increase your profits
- Source code availability—total programming flexibility
- Full Raima support services—including training

Whether you're writing a stand-alone DOS application, or one for UNIX accessing thousands of records, Raima Data Manager will put your application on the fast track. Race to the phone and call for more information!

**In the U.S. or Canada, call: 1-800-DB-RAIMA**

In Washington state or international, call: **(206)747-5570**

**Raima Data Manager™**  
**The High Performance DBMS**

### Specifications

Relational B-tree indexing. Network data model. Relational SQL query and report writer. Single & multi-user. Automatic recovery. Built-in referential integrity. Supports: VMS, QNX, ULTRIX, UNIX System V, Berkeley 4.2, AIX, SunOS, SCO, MS DOS, MS Windows, and OS/2. Most C Compilers and LANs supported.

**Raima Corporation** 3245 146th Place S.E., Bellevue, WA 98007 USA **(206)747-5570 Fax: (206)747-1991**  
**International Distributors:** Australia: 61 2 419 7177 **Belgium:** 32 2 734 9818 **Estonia:** 7 142 328 287 **Finland:** 358 080405350 **France:** 33 1 46 09 27 84 **Germany:** 49 7022 34077; 49 214 91051  
**Italy:** 39 49 829 1285 **Japan:** 81 33 865 2140 **Mexico:** 52 83 49 53 00 **The Netherlands:** 31 2159 46814 **Norway:** 47 2 38 48 88 **Russia:** 7 812 292 7210 **Singapore:** 65 334 0061 **Sweden:** 46 13 111 588  
**Switzerland:** 41 64 517475 **Taiwan:** 886 2 552 3277 **Turkey:** 90 1 152 05 16 **United Kingdom:** 44 992 500919 Copyright ©1992 Raima Corporation, All rights reserved. Photo: Dale LaFollette

Circle 156 on Inquiry Card.

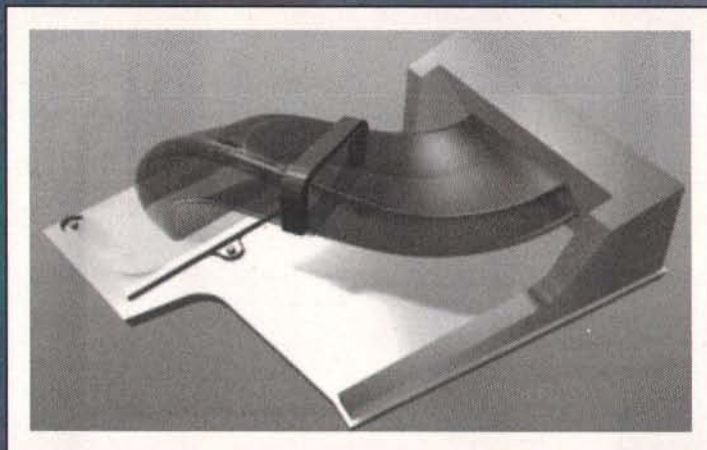


# All the benefits On a much

A size (8.5 x 11")



B size (11" x 17")



At last. A personal output device that combines the best features of a desktop laser printer with the ability to produce large C-size drawings. It's called ProTracer™ — a monochrome inkjet printer/plotter designed for the personal use of PC CAD professionals.

## MEDIA FLEXIBILITY

ProTracer is a desktop printer/plotter that lets you produce A, B, as well as large C-size output. It prints sharp, precise lines on a variety of media including plain and bond paper, plotter paper, and most vellum.

## SPEED

ProTracer is fast and quiet because it uses the latest Canon inkjet technology and an Intel i960™ processor. Just compare it to any other large format plotter and

you'll see. A complex C-size drawing often takes over half an hour on a pen plotter, while ProTracer completes the same drawing in as little as five minutes!

## HIGH QUALITY OUTPUT

ProTracer achieves its high quality output by utilizing a 64 nozzle printhead to deliver crisp lines and bold, high contrast blacks. Its 360 dpi resolution assures sharp lines needed for everything from the most complex engineering drawings to sophisticated text and graphics used in letters and reports.

## VERSATILE AND EXPANDABLE

Unlike other large format devices, ProTracer isn't limited to plotting. Instead, it can produce high quality finished output for a variety of applications including word processing, spreadsheets, and desktop



C size (17" x 22")



**FIRST RATE  
CUSTOMER SERVICE**

If you'd like to expand your personal printing and plotting capabilities, call Pacific Data Products at (619) 625-3579, Fax (619) 552-0889.

**PACIFIC DATA**  
**PRODUCTS**



### Lotus Organizes and Symphonizes

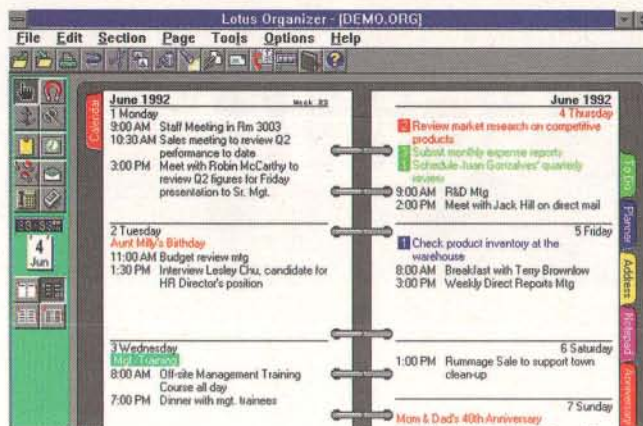
**R**ecently acquired from U.K.-based developer Threadz, Lotus Organizer uses a notebook metaphor to pull together the six sections of the program. Different-colored vertical tabs let you access Organizer's calendar, to-do list, planner, address book, notepad, and anniversary-tracking tools. Context-sensitive icons in each tool guide you in performing such tasks as selecting views, creating new entries, and building links between entries. You can also create multiple copies of particular notebook sections. Version 1.0 does not yet support Windows 3.1's OLE, but it is DDE-enabled.

In bringing new Windows products to market, Lotus has not forgotten the DOS platform. Symphony 3.0 integrates spreadsheet, word processing, graphics, database, and communications functions and includes Bitstream display and printer fonts. WYSIWYG display and spreadsheet-publishing capabilities, scroll bars, and sizable windows are new, as are improved memory management, a spreadsheet auditor, and an enhanced file viewer. **Price:** Organizer, \$149; Symphony 3.0, \$695.

**Contact:** Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142, (800) 343-5414 or (617) 577-8500. **Circle 1305 on Inquiry Card.**

### Unix Accounting

**V**ersion 7.0 of Unifacts Unix accounting software includes a new Cash Book facility, free-format in-



*The Lotus Organizer notebook interface even has rings down the center of the screen.*

voice layouts, and a price/discount matrix in the Sales Ledger. The enhanced Stock Control module includes three list prices and a quantity price discount structure for each record. Also, you can now search for products by description, as well as by product code.

Unifacts provides a gateway to open systems by storing data elements in C-ISAM format. With this format, you can create an on-line link to other packages and tailor Unifacts to your business requirements.

Available for SCO Xenix 386 and SCO Unix, the core Unifacts package consists of six modules: Sales Ledger, Purchase Ledger, Nominal Ledger, Invoicing, Payroll, and Stock Control. You can expand it to include additional Cash Book, Factslink, Sales Order Processing, Bill of Materials, Job Costing, Management Accounts, and Fixed Asset Register modules.

**Price:** Six-module core package, about \$3400 (£1795); extra modules, about \$665 (£350) each.

**Contact:** Pegasus Software Ltd., 35-41 Montagu St., Kettering, Northamptonshire NN16 8XG, U.K., 44-536-410044; fax 44-536-81796.

**Circle 1316 on Inquiry Card.**

### Expanded Database Support for IQ 3.0

**I**mproved screen-creation tools and expanded database support come with version 3.0 of IQ (Intelligent Query) for DOS. The database-independent report writer and query tool from IQ Software now works with more than 60 databases and file systems (including Structured Query Language and 3GL-based systems), with support for Informix, Ingres, and Sybase files provided in the current release.

IQ helps you create reports from simple columnar to complex free-form and matrix output using its pop-up menus for selecting and retrieving data and a screen painter for report layout. IQ's WYSIWYG screen painter lets you define areas for sub-headings and page footers. You can also incorporate long text fields with features such as margins, font control, and word wrapping. IQ now lets you create matrix (or

cross-tabulation) reports for generating spreadsheet-type summaries. Also included is a label generator, which offers more than 30 styles of labels. **Price:** Single-user license, \$500; 50-user license, \$17,000.

**Contact:** IQ Software Corp., 3295 River Exchange Dr., Suite 550, Norcross, GA 30092, (404) 446-8880; fax (404) 448-4088.

**Circle 1306 on Inquiry Card.**

### Peachtree Ships Major Accounting Upgrade

**V**ersion 6.0 of Peachtree Complete Accounting for DOS consists of three programs: Peachtree Basic Accounting, Complete Accounting, and a multiuser version of Complete Accounting, a start-up system for small businesses, includes tools for general ledger, accounts receivable, accounts payable, budgeting, billing, inventory management, reporting, and other tasks. Complete Accounting provides all the functionality included in the Basic program and adds a custom report writer and purchase-order, job-cost, payroll, and fixed-assets modules.

Peachtree Complete Accounting also lets you process handwritten checks, delete previously posted invoices, print your Trial Balance by range, and add new invoice formats, including a new service invoice and a customized invoice form.

**Price:** Basic Accounting, \$99; Complete Accounting, \$249; Multi-User Version, \$399 with unlimited user support.

**Contact:** Peachtree Software, 1505 Pavilion Place, Norcross, GA 30093, (800) 247-3224 or (404) 564-5800.

**Circle 1307 on Inquiry Card.**



# Have You Ever Wanted To Leap Out The Nearest Window?

## Take The Plunge With Proxy. It's Network Remote Control For Windows, From Windows.

Some things you expect in remote control software. Like lightning-fast speed. And control over both DOS and Windows on the host PC. But new Proxy gives you something you probably don't expect. Because it not only works with Windows, it works from Windows. And that makes all the difference.

You see, other remote control products run from DOS, even



Proxy supports host computers running Windows.

No need to abandon your own work when someone calls. Just click on a Proxy icon and instantly connect to the caller's machine. You now have full control of their hardware and software, complete with mouse and keyboard support, whether they're running Windows or DOS.

## Reconfiguring Lots of Workstations? Leap Out The Nearest Window.

Now you can perform administrative chores like software installation, updates, and system configuration without going from room to room. Just capture a PC and perform any operation as if you were sitting in front of it. You can even reboot it remotely!

## Need More Processing Power? Leap Out The Nearest Window.

Imagine off-loading your most CPU-intensive tasks to separate machines you control as if they were part of your own desktop. Imagine two, three, or more applications, each running at full speed because each has its own dedicated processor. That's the power of multi-processing with Proxy.

You can make Proxy available across the network and give power-hungry users access to spare or idle PCs. You can even dedicate PCs to specific tasks, like a high-powered 486 for CAD or a modem-equipped 286 for communications.

## Take The Next Logical Leap in Remote Control.

Get the most advanced network remote control available, with applications ranging from user support to multi-processing. Get Proxy. It's from Funk Software. The same people who brought you Sideways®, Allways, and other top-selling PC utilities.

Call today to order or for more information.

1-800-828-4146 Ext. 810 (U.S. and Canada)

# PROXY™



If it runs on the host, it runs in a Proxy window. Even graphical DOS programs.

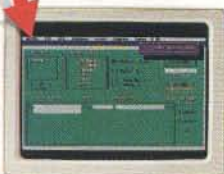


You can connect to multiple PCs over a network, with each appearing in its own window.

those that support a host running Windows. So they allow just one connection at a time, and demand total attention from your computer. But Proxy is a Windows application that lets you make multiple connections simultaneously. You can display and control a different host PC in each window you open, while you continue to run local applications.

## Users Calling For Help? Leap Out The Nearest Window.

If your job is to help users on the network, Proxy will make it easier.



Run time-consuming jobs on dedicated processors, and control them all from Proxy.

**FUNK  
SOFTWARE**

System Requirements: Proxy "Master" runs in Windows and can control multiple "Hosts" running DOS or Windows over an IPX network (e.g. NetWare).

© 1992 Funk Software, Inc. Proxy is a trademark of Funk Software, Inc.

Funk Software, 222 Third Street, Cambridge, MA 02142 Tel (617) 497-6339 Fax (617) 547-1031

Circle 221 on Inquiry Card.



# Finally, Might

## THE AST FAMILY OF SINGLE AND MULTIPROCESSOR SYSTEMS

**The days of the wrong-sized server are over.** No longer are companies willing to pay for more than

they need. Or settle for less because it's all they can afford. With AST's uniprocessor Premium® Servers and new multiprocessor Manhattan™ SMP systems, configuring the right size computing solution has never been easier.

**Scalable in all key areas.** AST's family of powerful Intel486™-based servers offer scalable memory, CPU, disk cache and storage for all types of environments. Our Manhattan SMP

	PREMIUM SE	MANHATTAN SMP
Processor:	66, 50 and 33 MHz i486-based models available*	Up to four 50 MHz, i486 processors
Memory:	Up to 80 MB RAM	Up to 256 MB ECC RAM
Data storage:	Up to 8 GB**	Up to 32 GB**
Expansion slots:	Ten 32-bit EISA	Eight 64-bit Cupid MPx, eight 32-bit EISA and two 16-bit ISA
Bus Architecture:	32-bit EISA	64-bit Cupid MPx and 32-bit EISA

\*All Premium SE systems feature AST's exclusive Cupid-32™ technology for quick and easy processor board upgrades. \*\* Additional storage available using optional Premium XP expansion cabinets.

even delivers minicomputer-comparable muscle at a fraction of a mini's cost.

**True open architectures.** Both our Premium Servers and Manhattan SMP systems utilize industry standard hardware and software. This means they're configurable with off-the-shelf peripherals and popular operating systems,





# Makes Right.



such as Novell® Netware®, SCO® UNIX® and Banyan® VINES®.

**Optimum reliability.** AST Premium Servers support the advanced fault resilient features of Novell NetWare. While the Manhattan SMP boasts advanced high-availability hard-



Microsoft



ware like disk array, self-correcting ECC memory and redundant power supplies. And both are backed by AST's comprehensive service and support, including optional 24-hour a day, 7-day a week on-site service for the Manhattan SMP.



In any multiuser environment, AST's family of servers provides a high-performance, high-availability solution that's always the right size. For more information, or to arrange a visit from an AST sales representative, call **1-800-876-4AST** today.

**AST**  
COMPUTER

The Power Of Choice.

AST markets products worldwide, for more information call AST International on (714) 727-9292 or FAX to (714) 8585. AST is a supplier to U.S. government agencies, GSA #GS00K92AGS6064. AST, AST logo and Premium registered and Cupid-32 trademark AST Research, Inc. The Intel Inside Logo is a trademark of Intel Corporation. All other brand and product names are trademarks or registered trademarks of their respective companies. Copyright © 1992 AST Research, Inc. All rights reserved.

Circle 462 on Inquiry Card (RESELLERS: 463).



## Turn Your PC into an Oscilloscope

Used with a Gage Compu-Scope data acquisition card, GageScope 2.0 turns your DOS-based PC into a 16-channel oscilloscope. GageScope provides real-time sampling rates of up to 100 MHz and memory depths of up to 8 MB. GageScope can display data with a time base ranging from 10 ns to 1 megasecond. You can perform absolute and differential measurements on-screen and zoom in to highlight areas of the signal. The software lets you load and store infinite numbers of signals and setups, the developer says, and you can perform data analysis via mathematical functions such as windowed FFT (fast Fourier transform).

**Price:** GageScope 2.0, \$100; FFT module, \$100.

**Contact:** Gage Applied Sciences, Inc., 5465 Vanden Abele, Montreal, Quebec, Canada H4S 1S1, (514) 337-6893; fax (514) 337-8411.

**Circle 1309 on Inquiry Card.**

## Graphing Options for DOS

More than 60 styles of 2-D, 3-D, and Statistical Process and Quality Control graphs are included in the version 2.0 upgrade of PlotIt for DOS. PlotIt graphs data directly from dBase, Excel, Lotus 1-2-3, or ASCII files and now supports thousands



*GageScope can display over 65,000 data points in 1 second on a 33-MHz 386 system.*

of third-party fonts. Also new are an automatic axis-value-setting function, the ability to compose multiple graphs in the same file, and support for rotated x- and y-axis labels. An On-Line Worksheet lets you perform data transformation and analysis via spreadsheet operations and graph the results. Also available for Windows, PlotIt has a 20-shade palette.

**Price:** \$495.

**Contact:** Scientific Programming Enterprises, P.O. Box 669, Haslett, MI 48840, (517) 339-9859.

**Circle 1308 on Inquiry Card.**

## Solve Chemical-Reaction Problems

Now you can solve chemical-reaction problems,

including reaction equations, heat balances, equilibrium compositions, formula weights, phase stability diagrams, and Eh-pH diagrams, on your PC with HSC Software for Windows. The package performs calculations using an integrated thermochemical database of more than 5600 compounds.

Equilibrium calculations help you observe the effects of process variables (e.g., temperature and amounts of raw materials) on product composition. HSC Software calculates equilibrium compositions using the Gibbs Free Energy Minimization method. A Cell Equilibrium calculation option is also available for calculating charge and composition of phases in electrochemical cells (e.g., batteries).

A program for calculating formula weights accepts any form of chemical formula using conventional organic or inorganic expressions (without superscripts and subscripts). HSC displays the formula weight and elemental composition as both weight and atomic percentages.

Phase stability diagrams offer a quick way to locate the stability regions of different phases at varying partial pressures of elements such as oxygen, sulfur, chlorine, and nitrogen oxide. For understanding problems of corrosion, dissolution, leaching, and selective precipitation, HSC can graphically display Eh-pH diagrams. You can draw simple diagrams with only one element and water, as well as more complicated diagrams with several elements.

**Price:** Single-user license, \$1250

**Contact:** Outokumpu Research Oy, P.O. Box 60, SF-28101 Pori, Finland, 358-39-826-111; fax 358-39-827-310.

**Circle 1317 on Inquiry Card.**

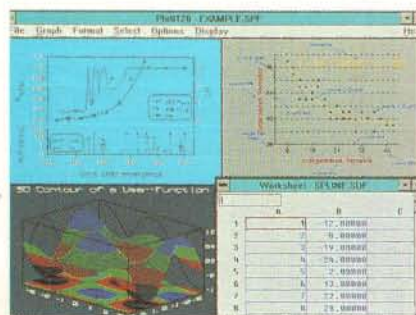
## A Substance-Based Equation Solver

With EES (Engineering Equation Solver), you can design equations using a wide variety of thermophysical property functions. Thermodynamic and transport-property functions for substances such as water, common refrigerants, nitrogen, methane, propane, helium, and other substances are included in version 3.0, which runs on Mac- or PC-based systems. EES lets you set up your equations in a word processor-like window. You can use the software to develop parametric tables by solving the same equation repeatedly with varying input data.

**Price:** \$400.

**Contact:** F-Chart Software, 4406 Fox Bluff Rd., Middleton, WI 53562, phone and fax (608) 836-8536.

**Circle 1310 on Inquiry Card.**



*PlotIt for DOS lets you build multiple 3-D pie graphs, pareto charts, bubble graphs, fence plots, and many other graphs in the same document.*





16 PPM

1000 LPM

# TWICE THE SPEED OF A LINE PRINTER HALF THE PRICE!

*Desktop*  
THE WORLD'S FIRST LASER LINE PRINTER

NOW WITH HP LASERJET® III & POSTSCRIPT® EMULATIONS!

## CONVENIENT SPEED

- Your continuous form printout stays in proper sequence
- No tray limitation; print an entire box of paper at a time
- **Line printer** output and speed, with **laser** print quality for half the price
- 8.5" x 11" paper for easy filing and binding
- Featuring Intel's i960™ RISC microprocessor for enhanced performance

## FLEXIBLE

- Works in HP or PostScript environments
- Ideal for LANs because it autoswitches emulations
- 100% HP font compatibility including Intellifont®

Intellifont, i960, PostScript, HP and LaserJet are trademarks of others and do not belong to Output Technology Corporation.

800-468-8788

**OTC** **OUTPUT  
TECHNOLOGY  
CORPORATION**

N. 2310 Fancher • Spokane, WA 99212  
Telex: #15-2269 OUTPUTSPOK FAX: (509) 533-1280



### Professional Image Processing

**T**he latest version of V, an image-enhancement and analysis package for PCs, turns your system into a scientific imaging workstation. The program includes expanded memory support, multiple image types, contrast processing, dual histograms, intensity profiling, color support, and algebraic operations. V2 also offers logical operations, extended mathematics, FFTs (fast Fourier transforms), and other functions.

V2 lets you process and display a variety of data types, from single-bit binary to 64-bit floating-point complex images. Contrast-processing facilities include linear stretching, intensity range remapping, and interactive binary thresholding. You can plot, compare, equalize, and match histograms of images and save histograms in a spreadsheet-compatible format. Geometric operations let you resize images and support noninteger scale factors and unequal horizontal and vertical scaling.

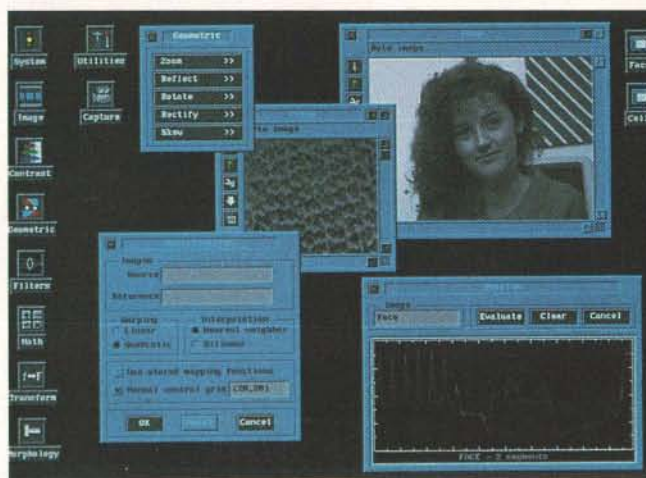
**Price:** \$1995.

**Contact:** Digital Optics Ltd., P.O. Box 35-715, Browns Bay, Auckland 10, New Zealand, 64-9-478-5779; fax 64-9-479-4750.

**Circle 1315 on Inquiry Card.**

### Draw and More

**A**t the heart of IntelliDraw lies a program that simplifies drawing by taking care of such tedious work as updating cloned items or aligning objects. Available for Macs and PCs, IntelliDraw combines elements of drawing, CAD, word processing, desktop publishing, and presentation programs in a single application.



*V2 lets you process and display a variety of data types. Your images can be anything from single-bit binary to 64-bit floating-point.*

IntelliDraw offers specialized tools such as the Connectigon, which lets you create live links among items. Other "intelligent" tools include the Symmetricon, which draws perfectly mirrored objects, and a framing tool that automatically aligns and spaces the objects it contains. Pop-up palettes give you access to freehand drawing, object blending, image locking, object matching, and other drawing tools.

**Price:** \$299.

**Contact:** Aldus Corp., 411 First Ave. S, Suite 200, Seattle, WA 98104, (800) 333-2538 or (206) 628-2320.

**Circle 1311 on Inquiry Card.**

### PC-Write Advanced 4.0

**A**lthough it's a DOS application, PC-Write Advanced Level 4.0 sports a

visual interface with pull-down menus, dialog menus, and context-sensitive help. The DOS word processor offers extensive customization options, improved column functionality, advanced mail merge, and multiple windows under DOS.

PC-Write offers drag-and-drop text movement, cut-and-paste operations, columns with multicolumn headlines, and page preview. A new button bar lets you keep frequently used commands close at hand and adapts to specific tasks such as memo or report writing. The program lets you move among 10 open documents at a time. It can import and export WordPerfect, DCA-RFT, and ASCII files.

**Price:** \$89.

**Contact:** Quicksoft, 219 First Ave. N, Suite 224, Seattle, WA 98109, (800) 888-8088 or (206) 282-0452; fax (206) 286-8802.

**Circle 1312 on Inquiry Card.**

### SPREAD THE WORD

Please address new product information to New Products Editors, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Better yet, use your modem and mail new product information to the microbytes.hw or microbytes.sw conferences on BIX. Please send the product description, price, ship date, and an address and telephone number where readers can get more information.

### Send and Receive Faxes in Color

**C**olorFax lets you send and receive fax images in up to eight colors with full fax-processing functionality. ColorFax includes an auto-dialer, editable send and receive queues for outgoing and incoming faxes, cover-sheet generation, and background transmission. You can zoom, rotate, and invert incoming fax files, and you can also edit incoming ASCII-based faxes.

The software supports any Intel Communication Application Specification-compliant fax board and also provides image conversion among file formats such as TIFF, GIF, PCX, and Targa.

**Price:** \$179.

**Contact:** Black Ice Software, Inc., Amherst Station, Rte. 122, Amherst, NH 03031, (603) 673-1019; fax (603) 672-4112.

**Circle 1313 on Inquiry Card.**

### First Speech Access Package for Windows

**W**indow Bridge lets blind users read Windows programs, such as word processors, databases, spreadsheets, telecommunications packages, and electronic mailers, via voice synthesizers.

When you move a mouse or an arrow key, the software instructs the synthesizer to verbalize an object, such as bit-mapped text, icons, dialog boxes, and buttons. You can attach voice labels to icons and have them spoken automatically.

**Price:** \$795.

**Contact:** Syntha-Voice Computers, Inc., 125 Gailmont Dr., Hamilton, Ontario, Canada L8K 4B8, (800) 263-4540 or (416) 578-0565; fax: (416) 578-0625.

**Circle 1314 on Inquiry Card.**

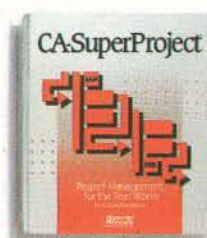


# Introducing Power Windows For Project Managers.

*The #1 Rated Project Manager Now Available For Windows.*

Power changes people.

Especially project managers.

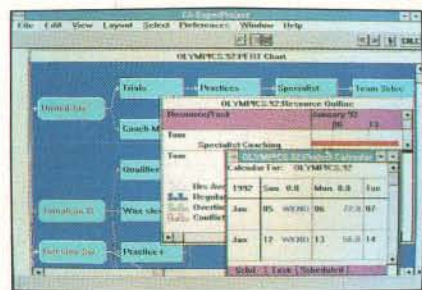


They're working smarter and faster with new CA-SuperProject® For Windows.

It's the world's most advanced, efficient and reliable project management software

— and now it's incredibly easy to use.

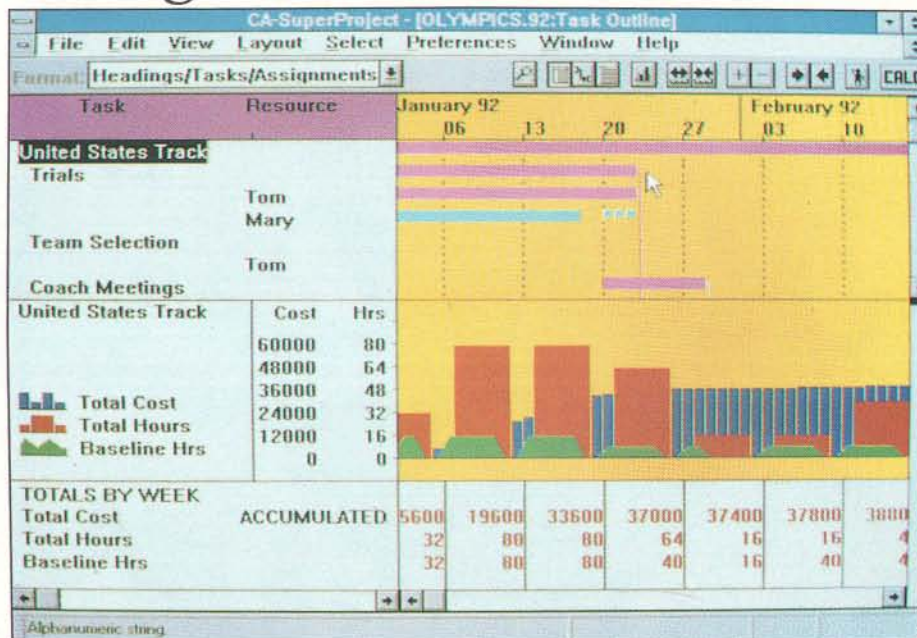
Total power is yours with just a few mouse clicks. Create and edit projects. Specify resources, task types and durations. Define integrated sub-projects. Build top-down hierarchies and task-



Report the status of your project with detailed Gantt, PERT, WBS and Cost/Resource charts.

dependency relations. Link multiple projects together for cross-project leveling. Perform extensive "what-if" analysis, revising schedules as projects progress.

You can bet your career on its



Manage with power, using tools for sophisticated planning, comprehensive resource management, tracking and controlling.

advanced and efficient scheduling algorithms.

A recent study of the five leading project managers proved it. Each was assigned the same



ing days—leaving Microsoft Project, Timeline 4.0, Project Workbench and Project Scheduler in the dust.

There's also a wide array of state-of-the-art graphics and detailed reporting tools to help bring your projects to life.

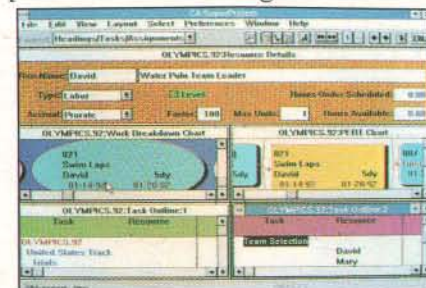
For your free Demo Disk, call 1-800-CALL CAI. Call today.

And find out what our power windows can do for you.

**COMPUTER ASSOCIATES**  
Software superior by design.

**CA-SuperProject® For Windows**

© Computer Associates International, Inc., One Computer Associates Plaza, Islandia, NY 11788-7000. All product names referenced herein are trademarks of their respective companies.



Show multiple views of the same project or different projects simultaneously.

project, but the finish dates varied by as much as five months. CA-SuperProject For Windows finished first in 214 work-

Circle 91 on Inquiry Card.





# "ALR PACKS POWER INTO NOTEBOOKS"

Info World June 22, 1992



If you think computing on the road means sacrificing the type of power you've become accustomed to, then you need to take a look at the new Ranger M486 from ALR. With a choice of high-powered i486 CPUs, the Ranger M486 is a match for any desktop PC. And, unlike other notebooks, the Ranger M486 is upgradeable. You can advance all the way up to 25-MHz i486DX™ computing by simply plugging in a new CPU module!

## Up To Five Hours Of Portable Computing!

With its advanced power management

circuitry, the Ranger M486 can keep going long after traditional notebooks have shut down. And its super



accurate "Gas Gauge" lets you know just how much power is left.

The Ranger M486 even has three internal ALR expansion slots.

Need a FAX/Modem, SCSI adapter, or data compression module? Just plug them in!



And with the addition

of our color display notebook, you'll be able to create lively and eye catching presentations.

We've taken the power and advanced 32-bit upgrade technology of our award winning desktop systems and condensed them into a lightweight portable PC. The Ranger M486 Series is the first notebook PC to offer a 32-bit modular upgrade path to full 25-MHz i486DX processing

## AND THE

### Choice of Upgradeable Processing Power... 25-MHz i486SX or 25-MHz i486DX

#### ALR Ranger M486 STANDARD FEATURES

- 4-MB RAM; Up to 16-MB on the system board
- 8-KB integrated static cache
- VGA graphics featuring 640 x 480 resolution
- 9" diagonal paperwhite LCD screen
- Hard Drive Options: 60-MB <19ms, 80-MB <16ms or 120-MB <15ms IDE Hard Disk
- 82-key embedded keypad with 10 function keys, inverted "T" cursor, 3mm key travel
- Up to 5 hours possible life with ALR PowerPlus Battery. Recharges in ~ 2 hours with system on or off
- One serial port; one parallel port; one mouse port; external VGA port; external keyboard/keypad and 160 pin docking station port
- Optional SCSI or scanner interface, data compression(2:1)
- Optional internal FAX/Data Modem (9600/2400; V2.2bis)
- ALR MS-DOS 5.0™
- 2.25"H x 11.75"W x 8.5"D, 7.2 lbs. (approximately).
- FCC Class B;
- Limited 12 Months; optional service and support program

**CALL NOW!**

ALR's PrimeLine Direct

**1-800-444-4ALR**

For More Information, and to order

**ALR®**

Advanced Logic Research, Inc.

9401 Jeronimo  
Irvine, CA 92718  
TEL: (714) 581-6770  
FAX: (714) 581-9240  
In Canada call 1-800-465-5979

Available at these nationwide locations:

**ComputerLand**  
Business to business. Person to person.

**Connecting Point** **COMPUTER CENTERS**

**ENTRE**

**WCC**

**ALR Power Partner Resellers**





**25-MHz i386SX™**  
**THE ALR PowerFlex FLYER 3SX/25**  
• i386SX microprocessor running at 25-MHz Upgradeable to 20- or 25-MHz i486SX™, 1-MB RAM, integrated Super VGA graphics (1024 x 768), 60-MB hard drive option

**\$699**



**20-MHz i486SX™**  
**THE ALR PowerFlex FLYER 4SX/20**  
• i486SX microprocessor running at 20-MHz Upgradeable to 25-MHz i486SX, 1-MB RAM, integrated Super VGA graphics (1024 x 768), 80 and 120-MB hard drive options

**\$995**



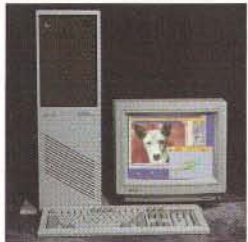
**33-MHz i486DX**  
**THE ALR FLYER 32DT 4DX/33**  
• i486SX microprocessor running at 25-MHz, Upgradeable to 33-MHz i486DX, and 50-MHz i486DX/2 4-MB RAM, integrated Super VGA graphics (1024 x 768), 120- and 200-MB hard drive options

**\$1,399**



**66-MHz i486DX/2™**  
**THE ALR FLYER 32DT 4DX2/66**  
• i486DX/2 microprocessor running at 50-MHz, Upgradeable to future Intel Overdrive processors, 4-MB RAM, integrated Super VGA graphics (1024 x 768), 120 and 200-MB hard drive options

**\$2,199**



**25-MHz i486SX**  
**THE ALR FLYER 32LCT 4SX/25**  
• i486SX microprocessor running at 25-MHz, Upgradeable to 33-MHz i486DX, 50-MHz i486DX/2 and 50-MHz i486DX, 4-MB RAM, Super VGA graphics (1024 x 768) 120, 340 and 535-MB hard drive options, 5 Security Features, 10 Expansion Slots, 12 Expansion Bays

**WINNER**  
INFO April 23,  
WORLD 1992  
**8.5**

**\$1,795**



**66-MHz i486DX/2**  
**THE ALR FLYER 32LCT 4DX2/66**  
• i486DX/2 microprocessor running at 66-MHz, Upgradeable to future Intel Overdrive processors, 4-MB RAM, integrated Super VGA graphics (1024 x 768) 120, 340 and 535-MB hard drive options, 5 Security Features, 10 Expansion Slots, 12 Expansion Bays

**WINNER**  
INFO April 23,  
WORLD 1992  
**8.5**

**\$2,795**

Founded in 1984, ALR is a public company with common stock traded on the NASDAQ National Market System under the symbol "AALR"

# DESKTOP, TOO...

**ON-SITE SERVICE**  
Call ALR for complete details

And ALR also offers the convenience and security of on-site service for as little as \$9.95\* a year!



**33-MHz i486DX™**  
**THE ALR BusinessVEISA 486/33**  
• i486DX microprocessor running at 33-MHz, Upgradeable to 50-MHz i486DX/2 and i486DX processors 32-bit high performance EISA bus 1-MB RAM, 120 and 200-MB hard drive options



**\$1,995**



**33-MHz i486DX**  
**THE ALR POWERPRO VM 486/33**  
• i486DX microprocessor running at 33-MHz, Upgradeable to 50-MHz i486DX/2 and i486DX processors Dual Processor Ready 32-bit high performance EISA bus 5-MB RAM, 340 and 535-MB SCSI hard drive configurations with 32-bit EISA controllers also available



**\$3,795**



**THE ALR Ranger M486**  
• i486SX microprocessor running at 25-MHz, Upgradeable to 25-MHz i486DX processors, 9" diagonal paperwhite LCD screen, VGA graphics (640 x 680), Up to 5 hours possible life with ALR PowerPlus battery- recharges in ~ 2 hours, 82-key keypad; inverted "T"; 3mm keytravel, 4-MB RAM, 60-, 80- and 120-MB hard drive models

**\$2,495 Model 60**

Color Ranger MC486 starting at \$3,495



ALR systems are put through rigorous compatibility testing to insure that whatever operating environment you choose your ALR system will perform above and beyond your expectations.



# THE DISK ARRAY YOU CAN HOLD IN YOUR HAND...

M I C R O  
*Array*

Now you can have the advanced technology of a fault-tolerant RAID subsystem - down-sized to match the size of a standard 5.25" drive.

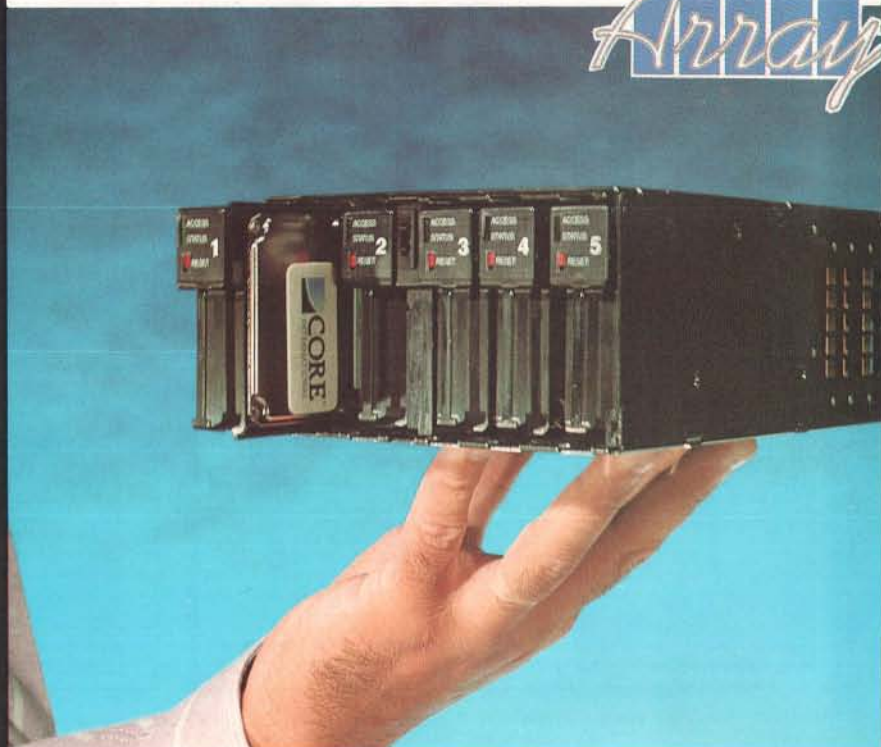
**MicroArray™** performs functions light-years ahead of mirroring and duplexing and at a cost lower than any other disk array available today!

Each **MicroArray™** provides more than 500MB of capacity and is easy to expand just by plugging in another drive. No reconfiguration necessary.

Our design features standard single ended or differential SCSI-2 interface, data striping and five **Hot Plug™** disk drives providing continuous data availability. Daisy chain up to seven MicroArrays per host adapter.

**MicroArray™** brings automatic fault-tolerance and RAID level data security to OS/2, Windows and DOS even though those operating systems do not support mirroring or duplexing. **MicroArray™** is also compatible with Novell® and UNIX.

The best news is that **MicroArray™** installs as easily as a standard SCSI hard drive, and it appears to the system as a single drive. No special drivers or controllers needed.



## ...FOR LESS THAN \$6,500.

COREwest 310/595-8966

COREeast 201/348-3330

COREsouth/central 407/997-6055

Federal Sales 301/258-8818

CORE International (U.K.) Ltd. 0344 861776

Headquarters & International Sales 407/997-6055

#### CORE Authorized Distributors

Graydon-Sherman 800/472-9366

Ingram Micro D 800/456-8000

Merisel 800/637-4735

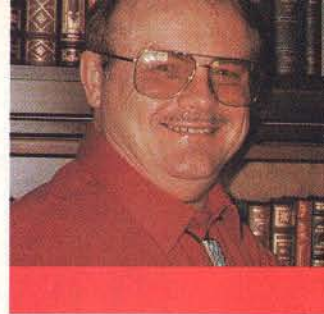
TENEX Data Corporation in Canada 416/291-7151



CORE International, CORE, and Hot Plug are trademarks of CORE International, Inc. Other trademarks referenced are the property of their owners. Copyright 1992 CORE International Inc.

**Circle 378 on Inquiry Card (RESELLERS: 379).**





JERRY  
POURNELLE

## ON THE ROAD AGAIN

**W**e're headed home from the Western Regional Science Fiction Convention in Phoenix. Robert's driving, the freeway is smooth, and while the light's plain horrible—the sun is directly on the screen—the Zenith Mastersport 386SL seems very much up to the task. When the backlighting goes off, the screen is invisible; but as long as it's on, I have no problems.

One presentation at Westercon was made by Dr. Bill Gaubatz, the McDonnell Douglas manager of the Delta Clipper DC-X program. DC-X begins the new breed of spaceship that General Graham and I sold to Vice President Quayle and his National Space Council a couple of years ago.

The full program develops into a spaceship that flies into orbit and returns without dropping parts downrange. Unlike the shuttle, it's single stage to orbit, everything reusable. Also unlike the shuttle, SSX (Space Ship Experimental) series ships take off and land vertically on a tail of fire, the way the lunar landers did during the Apollo series. When the ship lands, you refuel it and send it up again like an airplane. Next April we'll fly DC-X, a scale model of the orbiter, as a proof of principle and demonstration of SSTO technology and operations. This will be the first rocket ship whose design was driven by operations rather than performance.

University of California at San Diego's Dr. Vernor Vinge asked Dr. Gaubatz why this ship was possible now and wasn't 20 years ago when the shuttle was designed. "Microcomputers. You need on-board guidance."

### X for Salvation

The SSX program revives the X-ship concept of the 1960s, when government financed technology development programs while industry built and operated the actual products. The X-1 broke the sound barrier, and the X-15 flew to space. Others found what you could do with jet engines and odd wing shapes. X ships led to technology, not a government operation; they weren't prototypes. We'd build a few X ships, fly them to the edge of the performance envelope and beyond, probably crash them, and use what we'd learned to build them even better. The result was extremely rapid advances in technology.

In 1970 the U.S. had a favorable balance of trade; we exported more than we imported. Our major export was high technology—chiefly airplanes, but other high-tech stuff, too. Much of that grew directly out of the X programs.

Alas, Robert McNamara killed the X programs in the

name of arms control. They were just too effective in creating new and unpredictable technologies, and unpredictable technology was precisely what the arms controllers did not want. The result was that technology development slowed; and today the major export of the U.S. is agricultural products, not high technology.

Whatever the wisdom of that in McNamara's time, today the real threats to the U.S. are economic, not an uncontrollable arms race. If we're not going to be just another "developing" nation exporting food and raw materials to more advanced nations, we'll need all the high technology we can get. I'm no fan of big government operations like the Incredible Shrinking Space Station; but that's not what the X programs were about.

Indeed, we might well expand the X concept beyond airplanes and spacecraft to other technologies. Build working models, license the technology to American companies at a dollar a year, and use what's learned to move ahead while private industry makes products. I think it's high time to revive the X programs.

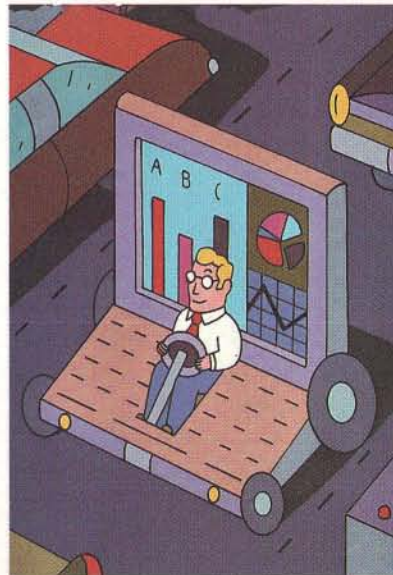
### BSE's Flashdrive

We're driving across the desert. The Mastersport's batteries lasted all the way to Phoenix, but I just got the "Low Battery" signal, so I set up my full lash-up: a Zircos 110-volt power supply powering up the Mastersport's regular external power system. I figure I ran the computer off batteries for about 4 hours.

I also have a new gadget, a 130-MB Flashdrive from BSE. It hangs off the parallel port, and it works just fine. I can remember when a 10-MB hard drive was the size of a small washing machine. Now I've got 130 MB in a little box about the size of a Walkman, and that tiny package includes rechargeable batteries.

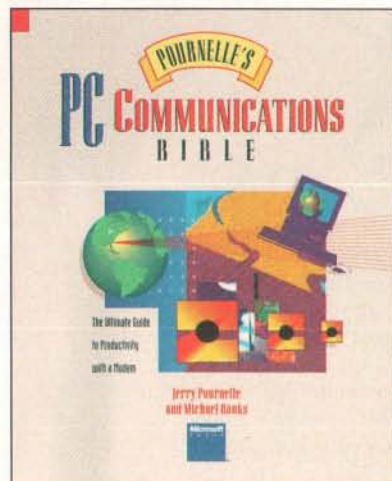
I installed the Flashdrive last night in about 30 seconds. You just connect it to the parallel port, switch over to

### The latest in portable hard drives and laptops arrive at Chaos Manor





# Modem Power



- A buyer's guide to modems and the latest communications software—choose the features you really need!
- A directory of online services—get the information you want fast!
- Troubleshooting tips—save time and money when problems crop up!

## *Pournelle's PC Communications Bible*

Wherever books and software are sold. \$27.95

## Microsoft Press

To order direct, call  
**1-800-MSPRESS**

Refer to ad ABY

Microsoft Press, One Microsoft Way,  
Redmond, WA 98052-6399

In Canada,  
Macmillan Canada, 416-293-8141

## USER'S COLUMN

the floppy drive, and type INSTALL. The Flashdrive takes care of the rest, and it gives you a 130-MB drive D or whatever is your next unused drive letter. It's considerably slower than the internal laptop drive, but for most purposes you don't notice that, particularly with a portable.

The Flashdrive has an internal battery. The software will power down the drive at an interval you set during installation; the default is 30 seconds. Access after power-down takes about 3 seconds, which is actually less time than the Mastersport's internal drive takes to power up (about 5 seconds), so saving a short file to the Flashdrive takes no more time than to the laptop drive. Longer files can be a pain, but I usually don't have many long files I need to transfer.

The power management works: I've had the Flashdrive running for a couple of hours now, and so far it shows no sign of power loss. There's also an external power supply.

The Flashdrive is really "just another drive": I tried putting the pop-up thesaurus on it, and that works fine. You can store programs or run them on the Flashdrive; your machine probably won't notice the difference.

Just before we left, I installed the Flashdrive software on the Cheetah 486. I transferred a lot of stuff from the Cheetah to the Flashdrive, discovering in the process that the Flashdrive works just fine under Norton Commander in both DOS and Windows 3.1. The software is cleverly done: when you reset or power up, if there is a Flashdrive on the parallel port, it will install itself; otherwise, it doesn't burden your system with it. This means that when I get back from the trip, I'll connect the Flashdrive to the Cheetah and copy over any work I got done. That's even faster than LapLink.

We have a 30-MB Flashdrive for Toshiba-san, the T1000 that Roberta used to carry before she fell in love with the Texas Instruments TravelMate 3000 WinSX; it has worked for years, so we're pretty confident about this new one. I'm still not completely happy until I've saved my work onto a floppy disk that I've removed from the machine, but that's old habits; the fact is that the Mastersport's hard drive is reliable, and so is BSE's Flashdrive, so saving on both ought to be enough. Meanwhile, I've got my whole computing environment on that disk.

### The Laptop Dilemma

The Mastersport is enough computer for just about anything I would want to do. Like any laptop, it has its limitations as a tablet, although given the Flashdrive,

capacity is not one of them; for that matter, it's got a large enough internal drive. It's a bit heavy to carry around as a notebook.

A few years ago that was no problem. Any machine good enough to write with wasn't really portable enough to carry to meetings and use there. Of course, what's "good enough to write with" has changed a lot. I can recall doing columns from Europe on an NEC PC-8201 that displayed eight rows of 60 columns—and that only because of Traveling Software's Ultimate ROM.

I got a lot of work done with that NEC machine; but then my primary machine was Old Zeke, a CP/M system that displayed only 16 rows of 64 columns each. The PC-8201 had no screen backlighting and only 32 KB of memory.

Nowadays, we expect a lot more of our portable machines. To get the greater performance, however, we had to put up with increasingly larger and heavier "laptops," until we got to the Zenith Supersport 386SX, a wonderful portable with great features, but weighing so much you couldn't really work with it on your lap. I carried that Supersport all over the world, but once I had lugged it into a hotel room, I was never tempted to carry it to meetings.

Things change. The Mastersport 386SL doesn't have quite as large a screen as the old Supersport did, but it's brighter, and I don't have any trouble seeing what I'm doing. The keyboard doesn't feel quite as good, but it's good enough. And the whole unit weighs only about a quarter what the Supersport weighed. I could stuff this machine into a briefcase and carry it to meetings.

There are drawbacks. Zenith, TI, and NCR laptops have fairly noisy keys, and while that's not a problem in a café, it sure would be in a meeting or a press conference. I'm told that one remedy for that is to get one of those plastic keyboard skin thingummies, and I suppose I ought to try that sometime, but I confess I'm not eager to.

Those machines are also fairly heavy and bulky: add a notebook computer to your briefcase, and it's the weight of several books. Put anything else in there, and once again there's that familiar list to starboard as the shoulder strap drags you over. Then, too, unless you habitually carry a briefcase or backpack, there's the decision, do you want to carry a briefcase or backpack at all?

### The New Safari

With AT&T's design smarts and NCR's marketing skills, you expect the NCR



# WAY MORE POWER...



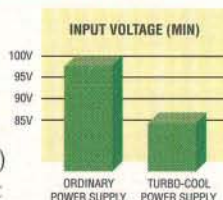
## ...IT'S JUST ONE OF 10 GREAT REASONS TO SELECT TURBO-COOL™ POWER SUPPLIES.

### 1. 50% TO 100% MORE POWER

The more power, the better! Our high-capacity units start drive motors with ease, run cooler, last longer, and allow for future expansion.

### 2. BUILT-IN LINE CONDITIONING

Turbo-Cool power supplies won't skip a beat when the line voltage sags. Their wide input range (85-135V, 170-270V) and heavy-duty input components protect your PC and its data from sags, surges and spikes.



### 3. FCC-B AND VDE-B LINE FILTER

A dual-stage EMI filter keeps electrical noise well below agency standards.

### 4. INDEPENDENT REGULATION

Turbo-Cool's superior independent-regulation design keeps output voltage tolerances 20 times tighter than that of an ordinary

power supply. This exceptional stability improves hard drive reliability during critical access periods.

### 5. ULTRA-CLEAN DC OUTPUT

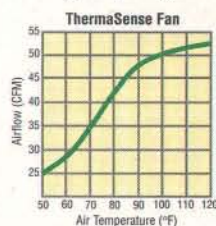
A dual-stage output filter ensures that sensitive computer chips receive pure, low-ripple power.

### 6. PROTECTION CIRCUITRY

Our units offer the most complete protection from dangerous overvoltage, overcurrent, and short circuit conditions.

### 7. THERMASENSE™ COOLING FAN

The Turbo-Cool 300 features ThermaSense, our high-capacity, thermostatically-controlled,



variable-speed fan. The cooling is ideal! High-performance systems operate up to 35° cooler while standard ones run as much as 75% quieter.

### 8. UL/CSA/TUV APPROVALS

Our high-capacity units are safety approved by not only UL, but also by Canada's CSA and Germany's strict TUV.

### 9. TWO-YEAR WARRANTY

Turbo-Cools are designed and tested for MTBFs of over 100,000 hours. They come with a no-hassle 2-year warranty and a 30-day money-back guarantee.

### 10. GREAT VALUE

Loaded with premium features, a Turbo-Cool power supply will upgrade the performance of your PC or LAN file server at a retail cost of only 55¢ to 80¢ per watt.



**PC POWER & COOLING, INC.**

"THE LEADER OF THE PACK"

5995 Avenida Encinas, Carlsbad, CA 92008 • (619) 931-5700 • (800) 722-6555 • Fax (619) 931-6988

Circle 141 on Inquiry Card (RESELLERS: 142).



Safari NSX/20 notebook to be different, and it is. They've gone about as far as you can go in making a true notebook computer out of a laptop. This handsome unit is lightweight and reasonably durable. The small door that covers the parallel port has had to be secured with duct tape, but that seems pretty standard for little covers on laptops; I can secure this one invisibly from the inside.

I've no real complaints about its construction. They've dropped the odd little handle from the earlier model, and it's as well: I thought I liked that handle, but in fact I never used it. The keyboard is about as small as a keyboard can get. The keys are somewhat stiff, but they will wear in. The Home and End keys are not as conveniently placed as on the Mastersport's keyboard, but I've found I can get used to just about any keyboard.

Naturally they've had to make compromises. The worst has to do with the trade-off between having a mouse-like device and having arrow keys. The Safari solves the mouse problem by replacing the normal arrow keys with three keys that together act as a mouse.

The center key acts as a small joystick,

**T**he NSX/20 is about as far as you can go in making a true notebook out of a laptop.

while those on each side of it act as mouse buttons. It's a bit awkward to use, and I find that clicking and dragging really requires two hands, but it does work; and it avoids having to attach the Microsoft Ballpoint Mouse or Logitech's TrackMan Portable mouse device. Those work very well—I like them—but they make the notebook considerably more unwieldy to carry about.

The mouse keys are very much a compromise, because it means that to get or-

dinary arrow-key functions, you must press and hold the blue function key while using the mouse keys as arrow keys. This means using two hands for activities that usually take only one.

In particular, most of my DOS applications want arrow keys, and some don't even know mice exist; not that it matters, because DOS applications like Norton Commander that will use a mouse can't find the Safari's mouse keys. I'm told Safari Systems may fix that in an update; it shouldn't be hard to do. Meanwhile, the mouse-key software will get out of the way if you load in software for a trackball or a real mouse.

The Safari runs Windows very well, and the mouse keys are adequate for that. They are not ideal. If you set the mouse speeds high enough to get the cursor quickly across the screen, the adjustment is a bit delicate for fine-tuned work; if you set it for accuracy, it's annoyingly slow for other work. Also, I do find it a nuisance to need two hands to click and drag. Still, you *can* use it, and it's often a lot more convenient than attaching a TrackMan Portable or Ballpoint. I'm glad that this option is available. There's also a setup

# You Can Look



9065s



T560i



T660i

And you'll want to take a look at NANA O's newest monitors. All day. Every day. Because these NANA O monitors deliver the highest flicker-free resolution in their class and conform to the strict new Swedish MPR II

requirements. Some even meet the TCO guidelines, the world's toughest VLF and ELF emission standards. You'll also find that each monitor has NANA O's *intelligent* front control panel.

Designed for computer graphics professionals, the award-winning FLEXSCAN **T-Series** features Trinitron CRTs, providing the sharpest contrast and brightest images in the industry. Low distortion and a wider display

1991 BYTE AWARD OF DISTINCTION applies to T560i monitor.



toggle so the mouse keys can become arrow keys.

The new Safari is considerably changed from the older AT&T model. Some things didn't change enough: the DOS font is better (I'm told because of my suggestion), but I still don't find it as attractive as the Mastersport's. However, I don't hate it. There are also bug fixes. The original Safari had a horribly inconvenient implementation of the blue function key. Now it works as you expect it to. The most important difference is that they've achieved low weight and a thin profile by eliminating the floppy drive.

There are two substitutes. One is an external 3½-inch floppy drive that can be attached with its own port and cable. It gets power from the Safari. Two Safari users could swap programs and data in flight by passing the drive back and forth. The other way to save your work is PCMCIA.

#### PCMCIA

The Safari has a small front slot for a PCMCIA connection. I didn't at first realize it, but that's probably the machine's most valuable feature. PCMCIA is going to have a *big* impact on the computer rev-

olution. Ed Coté of NCR thinks it will have as much effect as the AT did on the PC world. He may be right.

The immediate effect of the PCMCIA slot is that you can save your work to a 1-MB card about the shape of a baseball card but perhaps three times as thick. If one of these is in the slot at power-up, it becomes either the A or B drive (depending on whether you've got the external floppy drive attached), and it works just like an *extremely* fast 1-MB drive. It's odd to have the B drive faster than the C drive. Once you have saved, you can remove the memory card and put it in your pocket or replace it with another; and it appears to be as reliable a way to back up your work as anything else.

I guess I believe that, but my work isn't *really* safe until it's on a floppy disk. On the other hand, there was a time when I didn't trust 3½-inch floppy disks. If you carry the Safari and a memory card, and keep the external floppy drive and a power supply in your checked luggage, you can save any work done on the airplane—it's unlikely that you can do more than a megabyte of work—on the memory card and transfer the whole mess to a floppy

disk when you get to your hotel and set up your system with wall power.

Years ago I promulgated Pournelle's Laws of Computing. The first, "one user, at least one CPU," has proved accurate. The second, "silicon is cheaper than iron," said that electronics rather than precision-tooled metal would be the mass-storage devices of the future. So far that hasn't been true; but the PCMCIA is moving that way. PCMCIA memory costs about \$50 a megabyte (just like SIMMs), but that price is falling in the usual way.

However: it's important to realize that while the PCMCIA can be used as a non-volatile RAM disk, it is *not* just a memory card. That slot is a full I/O device, a bus extension if you will. You could hang a modem with all its software out there. You could also use it for data distribution: imagine a salesperson getting a full catalog-update database on a tiny write-protected card. You can put software on these cards and run it from them. Connect to your network through them. There are hundreds of potential uses for PCMCIA, and I expect to see a lot of them at this fall's Comdex. Stay tuned. The PCMCIA revolution is just beginning.

*continued*

# At Us All Day.



area make the *flat-square* FLEXSCAN **F-Series** the ideal monitors for those seeking an ideal Graphical User Interface and Desktop Publishing environment. For uncompromising quality at an affordable price, the FLEXSCAN

**S-Series** is your choice. And every NANAo monitor comes with a relentless attention to detail.

Whether you work in front of a 14" or 21" monitor, for two hours or twelve, you'll appreciate the

performance and ergonomics of NANAo monitors.

Take a look at your nearest NANAo dealer today, or for more information call NANAo.



## NANAo

1-800-800-5202

1-310-325-5202 (CA)

Fax: 1-310-530-1679



## The Ultimate Notebook

I like the Safari, and the PCMCIA slot is a neat feature; but when sitting in my hotel room, I prefer the Mastersport, and Roberta is extremely fond of the TI WinSX and its clone, Gateway's Nomad 420SXL. She carries them alternately. We find that the screens are somewhat better than those on other notebooks, and the keyboards on the WinSX and the Nomad seem to be the best keyboards of the lot, and they're certainly quieter.

I've just swapped over to the Safari, and having to use two hands to get arrow keys is a bit annoying; on the other hand, the machine is plenty good enough. I could easily finish the column with it and start in on fiction. I'm writing in Q&A Write, which is a DOS program I run under Windows, and there's no reason why I can't attach a real mouse and toggle the Safari's mouse keys to arrows. Moreover, the Safari is superb at communications, as you'd expect from an AT&T machine.

Meanwhile, there's a conference going on; and while I'm not at all tempted to carry the Mastersport to any meetings or panels, the Safari is lighter enough that I carried it to the Science Fiction Writers of America business meeting to take notes. Getting rid of the floppy drive did make the Safari lighter and thinner and just plain handier, and not having to attach a trackball makes it a lot simpler to carry.

All told, if you need to run Windows on a notebook computer that you'll actually carry around with you, I've found nothing that beats the new Safari. Recommended.

## The Alternative

The alternative to carrying a laptop is to use a palmtop. My son Phillip is an officer in the Navy. He runs his division on the U.S.S. *Tripoli* with a Poqet palmtop; and he loves it. I've previously told the story of my colleague in Moscow who wrote his TV news commentaries on an Atari Portfolio. He could two-finger-type on that about as fast as I can touch-type on a full-size keyboard.

I have or soon will get: the new Poqet, an Atari Portfolio, the HP 95LX, and FranklinQuest's Academy. The latter is not in the same class as the others, being more similar to the Boss or the Wizard, but with this difference: the Academy is capable of connecting up to FranklinQuest's Ascend, which is the Windows implementation of the Franklin Time Management system. I've become addicted to Ascend, which has changed my life for the better.

The big problem with palmtops is entering data. Most palmtop users are two-finger typists. I suppose I could unlearn my touch-typing and try two-finger banging if I'd thereby get real portability; however, the Academy uses a one-hand chord-entry system. The Academy's start-up documentation says you can learn the chord system in about two hours, and given practice can get up to about 45 words per minute one-handed. We'll see. I've seen Wayne Yacco using his Academy, maybe not at 45 wpm, but at a steady clip, so I know it's possible. The Academy has some neat little removable memory and software modules—alas, not PCMCIA compatible—greatly increasing the flexibility.

Anyway, over the next few weeks I'll be trying out various alternatives to carrying a notebook. Meanwhile, if you really have to carry a Windows notebook, look at the NCR Safari NSX/20.

## The Apple Scene

A few months ago we went to a party at the home of Joe Coulombe, the founder of the



## Tip #1: Travel Digital Style!

**W**hen it comes to terminals, the folks at Digital Equipment know the real McCoy. After all, they invented VT terminals. But they know a real VT terminal isn't ideal for every situation. That's why they chose KEAterm 420 for their field account teams.

The perfect partner for Digital's notebook—KEAterm gives the power of Windows to host applications. Run multiple VT sessions and other Windows applications—like Excel, Lotus 1-2-3, Word or WordPerfect—each in its own window.

Digital's field account representatives use KEAterm on their DEC notebook PCs. You can use KEAterm for Windows on your notebook or your office PC. And if you're a DOS user, KEA supplies ZSTEM VT320/340 emulation.

**Preview KEAterm 340 for Windows at Networkworld in Dallas, 13-15 October.**

KEA Systems Ltd. 3738 North Fraser Way, Unit 101, Burnaby, BC, Canada V5J 5G1 KEALink, KEAterm, ZSTEM, PowerStation, KEA and their respective product logos are trademarks of KEA Systems Ltd. All other brand or product names are trademarks or registered trademarks of their respective holders. Copyright © KEA SYSTEMS LTD. 1992. All rights reserved.

The Digital team knows what travels best. And they know a good VT emulator when they use one. Find out why thousands of Digital's account representatives are KEAterm users.



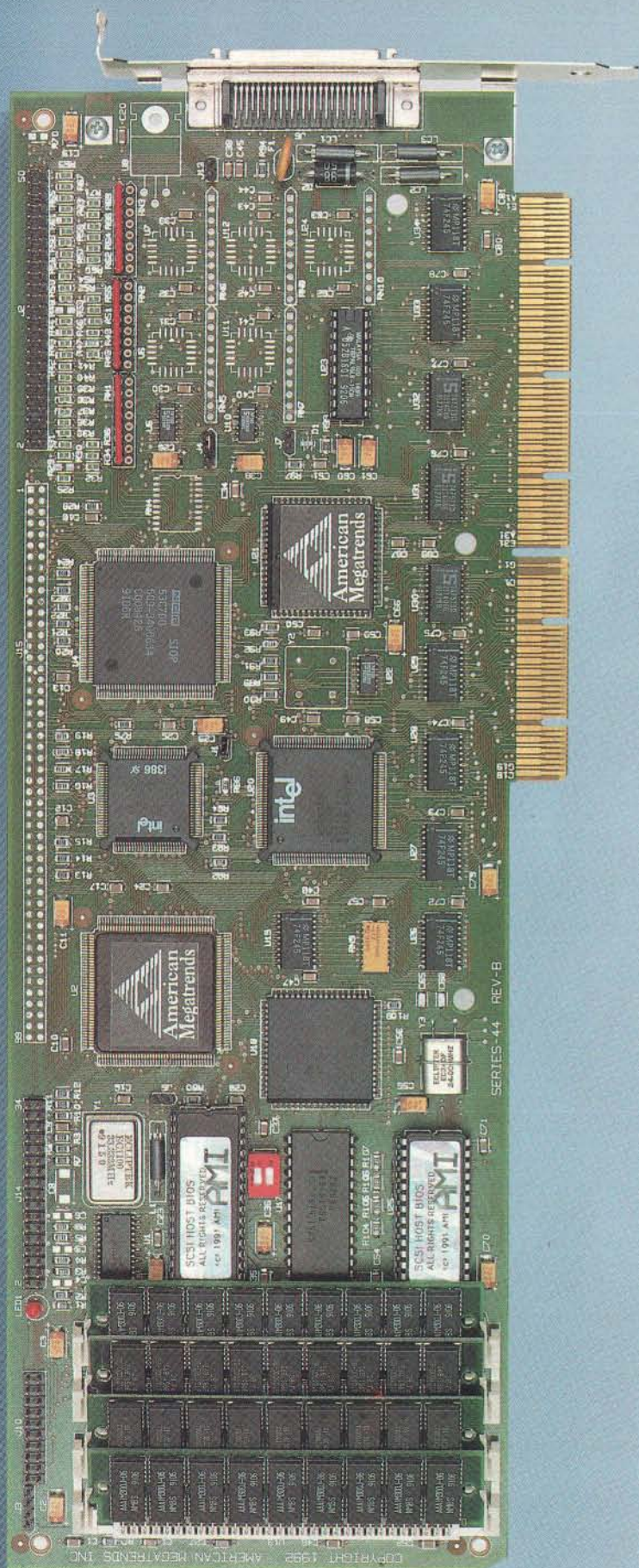
**KEA Systems Ltd.**

**Orders: 1-800-663-8702**

**Phone: (604) 431-0727**

**Fax: (604) 431-0818**





# EISA SCSI Caching

How do you move volumes of data from your SCSI device fast and efficiently? With the Fast Disk EISA SCSI Caching Host Adapter from American Megatrends.

## THE SUPERIOR PERFORMANCE SOLUTION

The Fast Disk SCSI controller supplies the industry's highest transfer rates and uses a 386SX CPU to manage up to 16MB of cache.

"...superlative disk performance - the best seen by PC Labs thus far - thanks to AMI's Fast Disk Controller, a 32-bit SCSI EISA card with a 386SX/16 microprocessor and 16MB cache." *PC Magazine - June 16, 1992*

## UNBEATABLE COMPATIBILITY

The Fast Disk SCSI Host Adapter is compatible with the popular Adaptec 154X and BusLogic drivers, and supports a wide assortment of SCSI devices, including hard drive, tape, CD-ROM and WORM.

## FROM THE LEADING EISA DEVELOPERS

As the leading developer of EISA motherboards and EISA BIOS, American Megatrends has the knowledge and resources to support your EISA applications. With over 150 combined years of EISA/SCSI design experience and the only company with both board and BIOS design knowledge, you are ensured compatible designs that work.

For full information on America's premium EISA peripheral cards, call American Megatrends today and see why more people move more data with AMI.

**AMERICAN MEGATRENDS, INC.**  
6145-F NORTHBELT PARKWAY  
NORCROSS, GA 30071  
(404) 263-8181, FAX (404) 263-9381  
(800) 828-9264, (800) U-BUY-AMI  
IN SINGAPORE (65) 294-6714  
IN THE U.K. (0293) 536-365



Distributed by **MERISEL** (800) MERISEL

Circle 68 on Inquiry Card (RESELLERS: 69).



# Join the New Imaging Revolution

**10:00  
Shoot**



The new *Canon RC-570 Still Video Camera* records 25 electronic photos on a reusable 2-inch video floppy disk. No film or processing. No waiting. No waste. The 3X zoom lens and 450-line frame video resolution ensure superior image quality. Speed, portability, ease of use, and direct playback to a TV monitor make the RC-570 an ideal imaging tool.

**10:12  
Process**

Canon digitizers allow still video images to be easily input to Macintosh®, PC, or NeXT™ computers. Integrate graphic files into applications like DTP, Databases, Multimedia and Presentations. You can even record from your computer back to video floppy with our *Electronic Still Presentation* systems.



**10:45  
Present**



Use the RC-570 still video camera connected to a TV monitor to deliver impressive computer generated presentations directly from your video floppy disk. No computers. No slides. No projectors. No hassles. *That's Revolutionary!*

Learn more about this revolution, call 1-800-221-3333 ext. 313.



**Canon**

© 1992 Canon USA, Inc. Still Video System Division, One Canon Plaza, Lake Success, NY 11042  
Brand and Product names are trademarks of their respective holders.

## USER'S COLUMN

Trader Joe's chain, where I get my coffee, cheeses, and blue corn tortilla chips. He had just got a new PowerBook, and he loved it.

They had another party last week, and he still loves it. Trader Joe's stores use Macs because, as Joe says, "It's a lot easier to get some useful work out of begin-

**T**he lack of a good portable was one of the limitations of the Mac. This is no longer true.

ners with a Mac. They learn to do things in a day."

I don't have a PowerBook, but everyone I know who does is happy with it. The lack of a good portable was one of the limitations of the Mac. No longer.

### Roberta's Story

System 7.0 works well, although Roberta finds that it takes getting used to. One correspondent reports that he has 130 copies of the clock open on his Mac Quadra. It takes the system 3 seconds to update them all, but meanwhile he was logged onto BIX with all that going on. Impressive. Windows won't do that, although I'm told OS/2 will.

Roberta uses a Mac more than I do. She does the LA Opera League newsletter using a Mac Quadra and PageMaker; and she's been adapting her reading program to run on Mac systems. It will probably end up in HyperCard, but her first attempt was to use SoftPC, a program that emulates a PC on the Mac. Here's her story:

"I was attempting to install SoftPC first on the Quadra. There are two sets of disks, with the third disk for each set being the data disk. All went well on the installation procedure until the data disk. About three-quarters of the way through, up pops the message: unexpected error -36 on line number 642.

"Suspecting things might go better if I used the standard set of disks, I try again with the second set. Same result.

"Take things downstairs to the Mac SE and try the two sets on it. Same result. I



# The only Windows™ statistics package you'll ever need.

**NEW**  
SYSTAT® for WINDOWS

## #1 for DOS and Windows

Rated "the best general-purpose statistics program" for the PC by *Software Digest*®, SYSTAT for DOS is now joined by SYSTAT for Windows. This addition to the SYSTAT family takes full advantage of Windows, with pull down menus, dialog boxes, sizable windows, and the ease of use you expect in a Windows package.

SYSTAT for Windows runs in standard and 386 enhanced modes and can take advantage of Windows advanced memory management. No matter how large or complex your analysis is, you can use SYSTAT.

SYSTAT delivers a balance of power and simplicity. It lets you analyze and manipulate data

with a comprehensive range of advanced statistical procedures, and present your results with stunning graphics.

## Just point and click

SYSTAT is a full-fledged Windows application. Just point and click. SYSTAT's QuickStat™ buttons give you simple, single-click shortcuts to common statistical analyses.

## More statistics, from the basic to the most sophisticated

A full range of univariate and multivariate statistics—from *t* tests to multidimensional scaling. With a few clicks you can turn most statistics into graphs and perform:

- multiway crosstabs with log linear modeling
- nonparametric statistics
- principal components and factor analysis
- cluster analysis
- time series
- nonlinear estimation
- correlation matrices
- means, effect, and dummy models
- post hoc tests

SYSTAT offers the most advanced multivariate general linear model available for Windows.

## The most graphics

No other statistical or graphics package can produce all the scientific and technical graphs that SYSTAT can—nor surpass its ease of use. Graphics capabilities include:

- histograms
- single, multiple, stacked, and range bar graphs
- single and grouped box plots
- stem-and-leaf diagrams
- pie charts
- scatterplot matrices
- 3-D data and function plots
- contour plots
- control charts
- maps with geographic projections
- Chernoff faces
- complete color spectrum
- log and power scales
- confidence intervals and ellipses
- linear, quadratic, step, spline, polynomial, LOWESS, exponential, and log smoothing

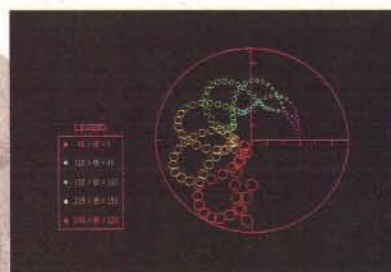
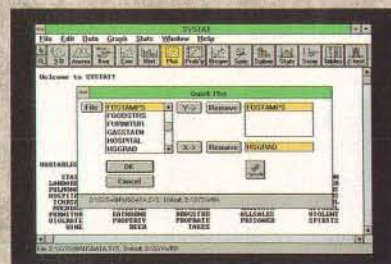
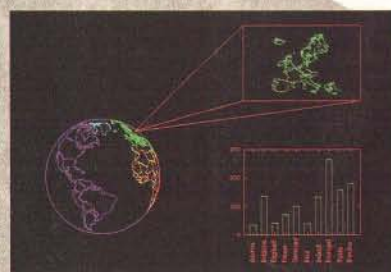
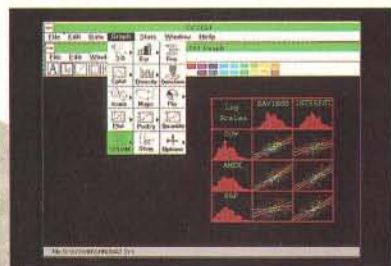
## A compatible family of products

Whichever you choose—SYSTAT for Windows, SYSTAT for DOS or both—you'll enjoy the most powerful statistics and scientific graphics software available for the PC.

For more information, special offers for current users, and demo disks, call:

**708-864-5670**

For Windows circle 178,  
For IBM/DOS circle 179.



**SYSTAT**

For more information call or write: **SYSTAT, Inc.**, 1800 Sherman Avenue, Evanston, Illinois 60201-3793. Tel: 708.864.5670, Fax: 708.492.3567

**Australia:** Hearne Marketing 61.3.8661766, **BeNeLux Countries:** Oasis 31.3402.66336, **Denmark:** Agrolab 45.64.406575, **France:** Deltasoftware 33.76.418508, **Germany:** STATCON 49.55.4272075, **Italy:** PiSoft 39.587.213640, **Japan:** HuLinks 81.33.5902311, **Malaysia:** Dagang Teknik 6.03.719.8299, **New Zealand:** Hoare & Assoc. 64.78.562675, **Spain:** AddLink 34.3.4590722, **Switzerland:** Fritschy & Partner 41.31.215151, **SYSTAT UK:** 44.81.4620093

© 1992 SYSTAT, Inc. *Software Digest* Ratings Report/8.5, May, 1991. *Software Digest* is a registered trademark of NSTL, Inc.



# A computer system

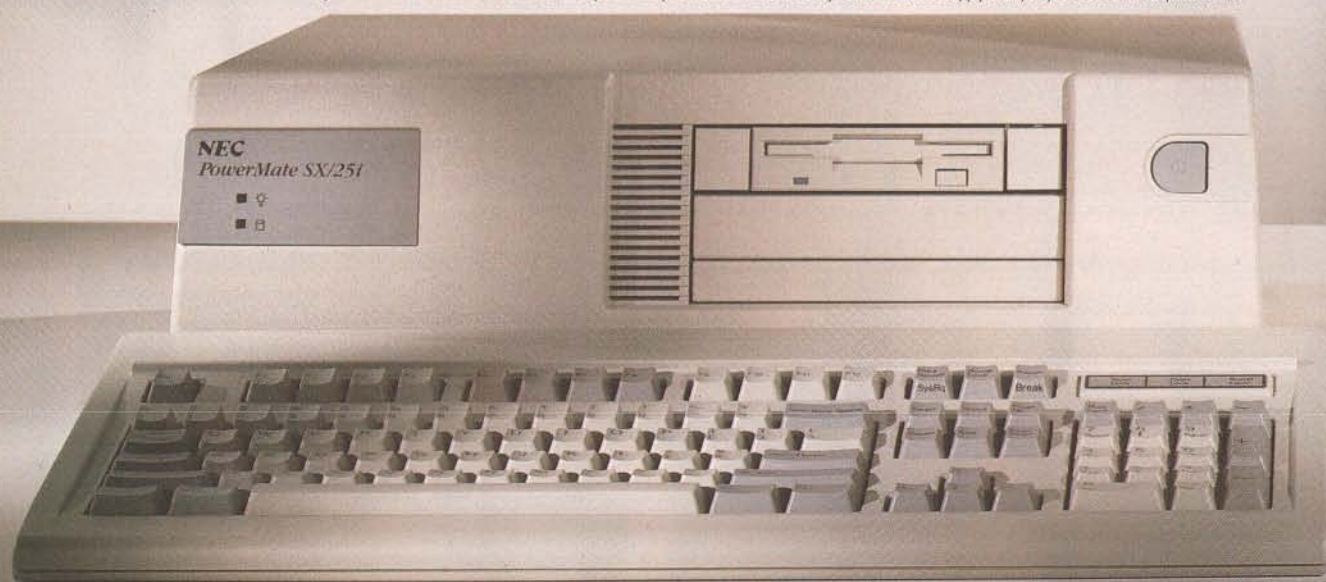
**One:** NEC's revolutionary PowerMate® Image™ Series PCs give you a combination of features no other computers can. Our PowerMate SX/25i, for example, has SuperVGA capability, for resolution as high as 1024 x 768. Plus NEC's unique local bus video, which speeds information display up to 200% faster than competitive systems.

**Two:** Our new generation of MultiSync® monitors have changed what people look for in a monitor. For instance, our new 15" MultiSync 3FGx™ has an active display area that's 36% bigger than most conventional 14" screens. Higher refresh rates. And NEC's FullScan™ capability, for edge-to-edge images with no black borders.

**The answer to your Windows™ problems.**

*Add a new MultiSync FG series monitor to one of our Image Series PCs and you get a computer system that's more than the total of its parts—with blazing fast graphics performance and the clearest, most flicker-free images imaginable. In short, you get the ideal system for Windows computing. Without spending a lot of money.*

\*Warranty covers all eligible PowerMate PCs and extends to eligible MultiSync monitors only when purchased with a PowerMate PC. On-site limited warranty for MultiSync monitors is in addition to standard two-year MultiSync monitor limited warranty. Other restrictions apply. Call (800) 388-8888 for complete details.






# that proves 1+1=3.

**Three:** Joining PC and monitor in perfect harmony is NEC's exclusive ImageSync™ technology. Each Image Series PC, when connected to a MultiSync FG monitor, automatically

tunes to the optimal refresh rate, producing crisp, steady images. Another plus—now selected PowerMate PC and MultiSync systems come with a one-year on-site limited warranty.\*



Because  is the way you want to go.

Circle 452 on Inquiry Card.

# NEC





\$99

## Grab It.

There's never been a better time to get FAXGrabber™, the first fax-conversion Windows utility for your PC fax card. It turns a static computer fax image into editable text. And it's now only \$99 instead of our normal \$149 price. • PC World says: *"if you receive a lot of PC faxes you'd like to manipulate... (it) can make your life a lot easier."* • And Home Office Computing explains why: *"the utility automatically—and in the background—converts the fax into text; launches into an application (so you can work with it); saves the text into a file; (or) places the text directly onto the Windows Clipboard... these features seem to make FAXGrabber almost indispensable..."* • To get hold of one, just call 1-800-4-FAX-GRAB today.

# CALERA

RECOGNITION SYSTEMS

Works with all leading fax cards. FAXGrabber is a trademark of Calera Recognition Systems. ©1992 Calera® is a registered trademark of Calera Recognition Systems, Inc. Outside USA (408) 720-0999 FAX (408) 720-1330. All other trademarks are property of their respective holders.

CALERA FAXGRABBER

## USER'S COLUMN

call SoftPC. The woman in technical support says that is an Apple error call. 'Just a minute. I'll see what my Apple manual says about this error.' Ruffling heard, and then a giggle. 'Well,' she says, 'I don't think this is going to help much. It says I/O error bummer.' She suggests I call the sales folks and ask for another disk. Electronic answering in sales. I leave a message that perhaps we need another disk and to call where and when. Assuming, of course, that they would like us to write something other than 'bummer.'

"Desiring to track things down a bit more, I call Apple because we bought our SE directly from Apple. They inform me that I must contact the dealer we bought the machine from. Learning that we bought the used machine from Apple directly, the spokesfemme says I must establish a relationship with a local Apple dealer. This is a little difficult because of the following circumstances. Our yellow pages indicates only five Apple dealers in Los Angeles. Two have gone out of business. Two have stopped selling to individuals. The fifth is about 100 miles north of us, and the machine must be brought in and a fee paid. All this to discover what the error message means? (I mean other than 'I/O bummer.')

"What is wrong with this picture?"

It's a good question. Macs are easy to learn and use as long as there are no problems. Learning what to do about errors leaves a bit to be desired. One partial remedy, suggested by BYTE's Tom Thompson, is to use the System Error DA (desk accessory), which is available on BIX in the Macintosh listings area as SYSERR31.SIT. It explains all those error codes and gives you a handle on what the real problem is.

Another remedy is to get yourself a copy of Larry Pina's book *The Dead Mac Scrolls* (ISBN 1-56609-016-4). Other excellent books are *The Mac Bible* (ISBN 0-940235-11-0) and *The Mac Bible: "What Do I Do Now?" Book* (ISBN 1-56609-014-8); all are published by Peachpit Press. If you have a Mac, you really need these books.

### Drawing and CAD

I recently installed Corel's Blockbuster, which was a package containing CorelDraw on CD-ROM, Corel SCSI, and a CD-ROM drive. I understand Corel Systems has discontinued that package, which is a shame, because it was the most painless way to install a CD-ROM drive I have ever seen.

However, Corel still sells the SCSI software, so you can use almost any CD-ROM drive. BYTE testing editor Stan Wszola

has used the Corel software to test removable-media SCSI devices and says that it has worked well with every device he tested.

Many of the modern CD-ROM drives are pretty good. There are also a lot of very slow drives for sale inexpensively; those will do for text retrieval, but they won't do for graphics-intensive programs like CorelDraw.

CorelDraw is wonderful. I have one reader who isn't strong on computers, and another who is; both are writing their Ph.D. dissertations, and both use CorelDraw to paste in illustrations and graphics. They're in biological sciences and need some fancy stuff, including doctored-up scanned images.

Another reader uses the low-end Windows Draw from Micrografx for the same purpose. He needs only monochrome line drawings, and he's extremely happy with Windows Draw. It's cheap, and it installs easily and gets things done fast without bother. If you don't need fancy color art, this may be the program you need. Otherwise, if you want the fancy stuff, the CD-ROM version of CorelDraw will do just about anything you ever wanted; and there's not a company in the world that understands system integration as well as the Corel people do. Corel SCSI works. Highly recommended.

### The Seybold Digital World Conference

I have to go to a lot of computer shows. Most are boring: I go for the exhibits and to talk to people, but I seldom go to the actual conference sessions. The exception is the Seybold Digital World Conference: it doesn't have much in the way of exhibits, but it doesn't matter, because you go to it for the conference itself. Because it's held in Beverly Hills and I live close by, I don't stay in the convention hotel; this is probably a mistake, because I tend to get out of the house late and miss some of the conference sessions.

Those sessions are all worth attending. The notion of the conference is that the digital TV, digital audio, animation, and computer people are all working away without talking to each other, but their work can't really be independent. It's best if they get together every now and again. This is the place they do it, from John Sculley of Apple to the CEO of Intel, and the domestic heads of NEC, Mitsubishi, and Philips.

Some of the sessions were better than others. A few sessions tend to be hype for upcoming products: of course, those can be interesting. I did get somewhat weary of the seminar of critics trashing American



# Why do they call it a dongle?



He wasn't famous. He didn't drive a fancy car, but dressed in his favorite Comdex T-shirt and faded blue jeans, he set out to change the course of the computer software industry. Quite a task for a lonely software developer.

Sitting in front of his

computer, drinking pots of coffee and smoking cartons of cigarettes, he'd write pages

of code.

It took time. Years in fact. But he did it. He wrote the most powerful computer program in the world. Now came the hard part. Selling it.

## The Most Powerful Program in the World

Determined to make those long years pay off, he called on every distributor, VAR and dealer in the world. He drove from Beantown to San Diego. Flew from Dublin to Borneo. Everyone loved the program.

So he sold a few. Only a few.

Back in Boston he waited. After a long year

with only 13 orders he set out to see what happened. As he drove across the



country and flew around the world he

discovered everyone knew about his program. Everyone had it too.

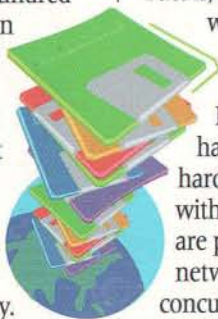
## The Global Marketplace

From Paris to Prague, his program was everywhere in Europe. When he got off the plane in Hong Kong he found his program stacked to the ceiling in every computer store. Amazed in disbelief, he bought a hundred cartons of cigarettes and a hundred pounds of Indonesian coffee and flew back to Boston.

Beaten, battered and bruised he went back to the drawing board. This time he would really change the face of the software industry. He would develop a device that would prevent unauthorized distribution of software programs.

## Call It What You Like

He developed a hardware key. His peers applauded his efforts. Finally, a solid solution for revenue protection.



But he didn't know what to call it. He thought of naming it after an exotic place he visited in his travels. Madagascar was a bit too long, though.

"Name it after you, Don!", urged his peers. So he did. Soon everyone was calling the key a dongle, after Don Gall—the lonely software developer who did what he had to do.

## You've Come A Long Way, Baby

Today, dongles are different. Fact is, they've come a long way. Leading the industry with security solutions, Rainbow Technologies has changed the face of hardware keys. They work with multiple applications, are programmable and network versions control concurrent usage. And they're always transparent to the end-user.

## Sentinel Family from Rainbow

Truth is, more and more developers are using keys. And the Sentinel Family is the most widely used in the world. In fact, over 6,000

developers use Sentinel from Rainbow. Why? They are simply the most effective, reliable and easy to implement keys on the market.

Learn more about securing

your software and how keys provide developers with extra value.

Call for a free copy of "The Sentinel Guide to Securing Software." And see just how easy it is to

install a hardware key into your application in just minutes. Try it with our low cost Sentinel Evaluation Kit.

Order one for your DOS, OS/2, Windows, Macintosh or UNIX based application.

And remember, when you need a dongle, you need Sentinel—the only dongle Don Gall would use.

European Headquarters  
**44 0932-570066**

Pacific Rim/Latin America Headquarters  
**714/ 454-2100**

Distributors located worldwide.  
Call for a distributor near you.

**SENTINEL**  
Securing the future of software



## Some call it a dongle. Those who know, call it Sentinel.

**RAINBOW**  
TECHNOLOGIES

### NORTHERN EUROPE

4 The Forum, Hanworth Lane  
Chertsey, Surrey, KT16 9JX, United Kingdom  
tel: 44 0932-570066 • fax: 44 0932-570743

### CENTRAL EUROPE

Oskar-Messer-Strasse 16  
Postfach 1243, D-8045 Ismaning, Germany  
tel: 49 089-961 3051 • fax: 49 089-961 2617

### SOUTHERN EUROPE

2 Allée des Aulnes  
78190 Trappes, France  
tel: 33 1 3050 4411 • fax: 33 1 3050 6276

### PACIFIC RIM/LATIN AMERICA

9292 Jeronimo Road  
Irvine, California 92718  
tel: 714/ 454-2100 • fax: 714/ 454-8557

CALL FOR YOUR FREE GUIDE TO SECURING SOFTWARE

Circle 159 on Inquiry Card (RESELLERS: 160).



popular culture. Far better was another session by entertainers and artists who are just discovering these new tools and are excited about what they can do with them. There was another on protection of intellectual property, a matter of great interest to me; and a number of projections about new consumer products incorporating digital technology.

That technology leaps ahead. I think we are already at a point at which photographs can be so expertly doctored that you can't

tell it was done: meaning that courts are going to have to think hard about what is and is not admissible photographic evidence. It's much the same with recorded speech; it will not be long before I can synthesize anyone's voice and have it say anything I like.

We live in interesting times.

#### Science Adventure

Science Adventure: Discoveries That Changed Our World is marketed as a trib-

ute to Isaac Asimov. His white mutton-chops dominate the cover.

This is the third in the series of interactive books by Knowledge Adventure. They characterize it as "multimedia without a CD-ROM," and it comes on six floppy disks and needs 8 MB of disk space. Installing that on the hard disk takes time, but the graphics on the screen at start-up are interesting. Roberta thinks that installation programs for educational software should provide you with something to think about while waiting for the whirring and swapping to stop. The graphics look great on her VGA Zenith Flat Technology Monitor.

The subjects covered are math, physics, chemistry, life, technology, earth and ecology, and space. Obviously they didn't get everything on each of these subjects on six disks, but they have done a good job of selecting their material and doing dynamic links.

As with their other products, there is a small globe, a text window, a navigation window, a time line, and a large picture window. One of the navigation buttons is for sound, but you don't really need it. Roberta ran this with the Disney Sound Source and says, "Hearing the sound of dropping water did not increase my understanding, but hearing Edison's first message on the phonograph might be worth it."

She continues, "I browsed for a couple of hours without boredom. The depth is not as great as one would find on a CD-ROM, but I think there is enough to create more curiosity in a student or even the parent. For instance, they describe logarithms but not cosines."

"The required game is included, but I hope the company will give it a little more thought. Neither the on-line help nor the 24-page documentation was sufficient for me to know when I was on the correct path. Typing speed becomes critical, which is a mistake, I think. If one pauses more than a couple of seconds while navigating, the program thinks you are beginning your answer again. This will frustrate a serious contestant who has the will to win."

Recommended.

#### DeMystifiers and Other Tools

If you develop Windows programs, you may need these tools. DeMystifiers gets inside Windows programs to tell you what is going on. I'll probably have more to say about this program when I do a full report on my own efforts to develop Windows programs using Visual Basic and Windowcraft.

DeMystifiers consists of five smaller programs to monitor internal Windows

## isobar® — THE BEST SURGE SUPPRESSOR JUST GOT BETTER!

### BETTER FEATURES

We took **isobar**®, the world's best surge suppressor, and gave it the **Ultra** enhancement. Now, in addition to premium AC surge and noise protection, the new **isobar**® **Ultra** has:

#### DIAGNOSTIC CIRCUITRY

- LEDs alert you of
- Improper outlet wiring
- Damage to protection circuitry
- Loss of AC power

#### INSTANTANEOUS RESPONSE

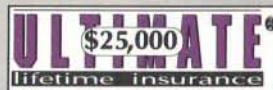
Suppresses spikes quicker to protect your equipment better.

#### ISOLATED FILTER BANKS

Eliminates interference between plugged-in equipment.



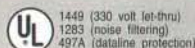
500 N. Orleans • Chicago, IL 60610  
312/329-1777 • FAX: 312/644-6505



### BETTER WARRANTY

Only **isobar**® **Ultra** provides lifetime **Ultimate**® **Insurance** that covers any surge related equipment failures up to \$25,000—including lightning strikes.

Isobars are available with 2, 4, 6 or 8 outlets, some with fax/modem protection. Call us today to see a sample.

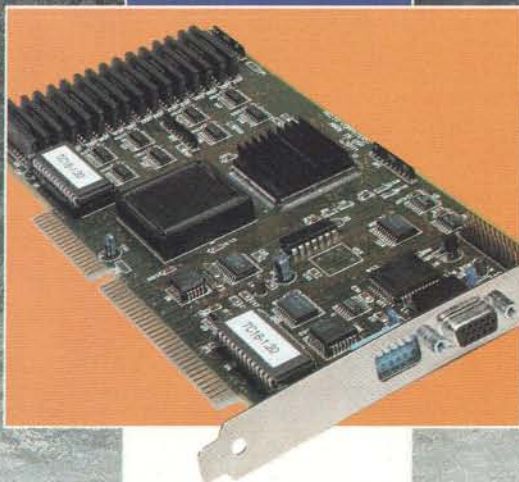
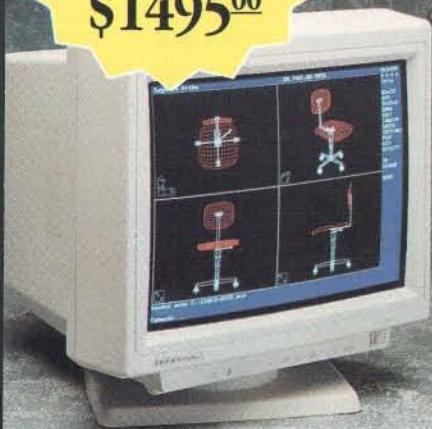




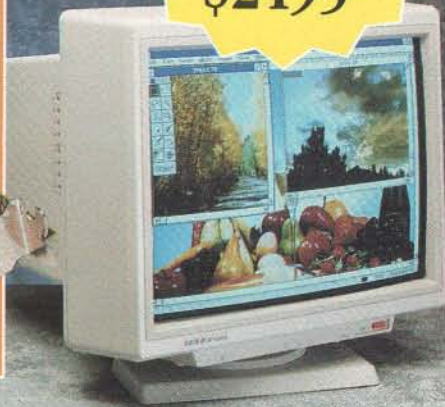
Announcing Idek's Resolution Revolution

# Now You Can Get True 1280 x 1024 Non-Interlaced Color at VGA Prices

**IDEK  
MF-5317  
with HELIO  
TC-1280-256  
\$1495<sup>00</sup>**



**IDEK  
MF-5221A  
with HELIO  
TC-1280-256  
\$2495<sup>00</sup>**



#### Idek MF-5317 Features:

- 17" FST
- VGA - 1280 x 1024
- .28 mm dot pitch CRT
- 30-65 kHz
- MPR II

#### Helio TC 1280-256 Features:

- 1280 x 1024 non-interlaced
- S3 accelerator
- 256 colors at 1280 x 1024

#### Idek MF-5221 Features:

- 21" FST
- VGA - 1280 x 1024
- .31 mm dot pitch CRT
- 30-80 kHz
- MPR II

**Idek and Helio Computer have joined forces to offer you Idek's advanced 17" and 21" flat screen monitors with Helio's high resolution 1280 x 1024 non-interlaced graphics board ... giving you unmatched true colors and resolution at VGA prices**

There's a revolution going on in flat screen monitor performance! Two of the industry's pioneers are breaking all the rules ... by offering you "true" 1280 x 1024 non-interlaced performance at VGA level prices!

With either of these Idek 17" or 21" monitors, you'll enjoy state-of-the-art flat screen monitor technology combined with automatic frequency scanning. Add to this the performance-boosting power of Helio's high resolution graphics board, and you've got an unbeatable monitor at an unbelievable price.

\* Offer valid in North America

The offer won't last forever, so now's the time to act! Take advantage of these revolutionary package prices ... and get the kind of color performance and resolution you've always wanted!

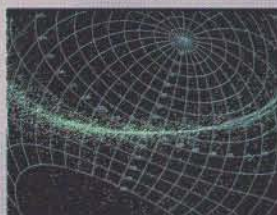
**Iiyama North America Inc.**, 650 Louis Drive, Suite 120, Warminster, PA 18974 U.S.A.  
Tel: (215) 957-6543. Fax: (215) 957-6551.

**IDEK  
Iiyama**

**Call 215-957-6543\* for the name of the distributor/dealer nearest you.**



## DISCOVER 1992 INNOVATION AWARDS FINALIST



## ALTER FOREVER YOUR SENSE OF SPACE AND TIME

*Dance of the Planets* is a rich and accurate animated model of the sky and solar system driven by true gravitational simulation. Never before has astronomy been so accessible. Go *beyond* the calculable to discover lost comets and errant asteroids, orbital resonance and chaos. With over 6,500 solar system objects and 10,500 stars and deep sky objects, the possibilities are open ended.

*"most imaginative and imagination-inspiring software I have yet seen running on a PC..."*

**Richard Berry,**  
Astronomy Editor in Chief

## DANCE OF THE PLANETS™

Order Today  
1-800-SKY-1642

ARC Science Simulations  
P.O. Box 1955B  
Loveland, Colorado 80539

IBM compatible, 640 k, EGA/VGA,  
HD, Math coprocessor recommended.  
\$195 + s&h. Literature, demo available.  
1-303-667-1168 FAX: 1-303-667-1105



## USER'S COLUMN

messages, investigate the capabilities of devices and device drivers, and look at selected parts of your I/O routines. Think of it as a high-level debugger. Understand, I haven't done much with the program, so this is mostly to let you know it exists. More another time.

### OS/2

I haven't got far yet working with OS/2. I can report that it's really nifty as a means for multitasking and running DOS programs, provided you have an advanced system with at least 8 MB of memory. It's much easier to set up DOS programs so they multitask together in OS/2 than in Windows.

OS/2 is not so hot on Windows applications, since it makes them run in standard mode and doesn't understand version 3.1. It's a better DOS than DOS, but not necessarily a better Windows than Windows. The installation program sucks toxic waste. More next month.

### Winding Down

My book *Pournelle's PC Communications Bible* is out from Microsoft Press. It bills itself as "The Ultimate Guide to Productivity with a Modem." I call it "my book," but in fact Mike Banks did more of the work than I did.

The book isn't intended for experts, but if you're an expert, you may want to keep one around to hand people so you won't have to answer all their questions. It's pretty complete.

The real computer book of the month is Martin Heller's *Advanced Windows Programming* (Wiley, ISBN 0-471-54711-5). The subject of this book is quite over my head; but Martin Heller has always been good at explaining complex concepts in simple language, and this is no exception. If you do advanced Windows programming, you need this; if you don't but you are thinking of trying it, you definitely need it.

The book of the month is by Marvin Harris, *Cows, Pigs, Wars, and Witches: The Riddles of Culture* (Vintage, ISBN 0-394-48338-3). Ever wonder if there's a practical reason for cow worship in India? There is.

The game of the month is *Might and Magic 3* from New World Computing (P.O. Box 4302, Hollywood, CA 90078). Understand, this isn't so much a game as a career: you'd better like investigating dungeons and strange places, because you will *not* finish this quickly. I'm only partway through. My son Alex got so intrigued with the game that he went out and *bought* a copy.

Next month I continue with my look at

## Just Add Code.



32-bit protected-mode Fortran

Your Fortran code is important. Trust it to the company that has been writing award-winning Fortran language systems for 25 years.

(800) 548-4778

**Lahey**  
Computer Systems, Inc.

Fortran is our forte

(702) 831-2500 ■ Fax: (702) 831-8123 ■ P.O. Box 6091 ■ Incline Village NV 89450



# MINUTEMAN PLUGS IN WORLDWIDE.

Now get total power protection from MINUTEMAN anywhere in the world. MINUTEMAN takes charge worldwide with instant protection when you need it most.

Every day your company relies on its voice and data communications equipment to stay productive. Unfortunately, the electricity that powers these vital systems is not reliable.

Blackouts, brownouts, spikes, surges and even lightning strikes are common. And the high cost of losing vital information and productivity due to power outages and



surges calls for preventive measures.

But power requirements can be confusing. And your company has unique needs that often require custom solutions.

MINUTEMAN offers the most comprehensive line

of UPS systems available, protecting all your business equipment from stand-alone workstations to the largest of the IBM AS/400s.

MINUTEMAN products are sold and serviced worldwide. Call on our skilled professionals to help you determine your exact power protection needs.

#### MINUTEMAN PRODUCTS

- On-line and standby UPS
- Shutdown software for every available operating system
- 300VA to 10KVA
- TUV approval
- Now in over 100 countries
- Regional service centers
- Automatic voltage regulators
- All international voltages

Contact our Power Professionals on the **POWER FAXLINE** below, or call (214) 446-7363 for your free Power Protection Guide.

**(214) 446-9011 Fax**

**MINUTEMAN®**  
UNINTERRUPTIBLE POWER SUPPLIES

**Reduced prices  
up to 36%**

**Call for complete price list.**



Our MINUTEMAN Global Socket (GS) Series un-interruptible power supplies accommodate the unique needs of our international customers. You no longer need to use adaptors or cut and splice on a new plug. Our GS UPS systems are universal and compatible with all major

plug patterns.

Our UPS systems are ready for both the individual computer and for your network. These popular MINUTEMAN UPS systems

employ our advanced technology to create the most dependable UPS available.

By integrating the latest MOSFET technology requiring fewer components, each GS Series

model is more compact.

The result is a truly advanced and economical UPS for all your business needs, worldwide.

**Global Socket UPS systems are universal and compatible with these plug patterns.**

- British (standard)
- European (Europlug)
- Australian
- Italian
- French

**NOVELL  
TESTED**



**Circle 140 on Inquiry Card.**

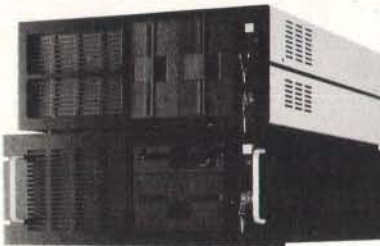




# Rack & Desk Chassis

FOR IBM XT/AT/286/386/486

Integrand's unique packaging design uses modular construction. We have 3 basic models for ISA/EISA bus computers. Over 90 interchangeable modules allow you to customize them to nearly any requirement. We make drive enclosures and rackmount keyboards too. Integrand offers high quality, advanced design hardware and strong support. Why settle for less?



## Rack & Desk Models

Accepts Most Motherboards and Passive Backplanes

Doesn't Look Like IBM

Rugged, Modular Construction

Excellent Air Flow & Cooling

Designed to meet FCC

204 Watt Supply, UL Recognized

200 & 300 Watt Supplies, UL, CSA, TUV

Reasonably Priced

**NOW AVAILABLE** Rackmount Keyboards



Three Models: Drawer, Shelf, and Panel  
Reasonably Priced

Call or write for descriptive brochures, prices  
or applications assistance:

**INTEGRAND**  
RESEARCH CORP.

8620 Roosevelt Ave. • Visalia, CA 93291

209/651-1203

FAX 209/651-1353

We accept VISA and MasterCard

IBM/XT/AT TM IBM • 286/386/486 TM INTEL. Drives and computer boards not included.

## USER'S COLUMN

palmtops, more on OS/2, and a look at sound boards; and maybe I can make short shrift of a huge pile of really nifty programs and CD-ROMs stacked on the ready table. I'm also expecting more PCMCIA cards. As usual, the computer revolution pours out more than I can write about, and I love it. ■

*Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who*

*also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerry."*

## ITEMS DISCUSSED

**Academy** .....\$299

FranklinQuest, Inc.

2550 South Decker Lake Blvd.,

Suite 26

Salt Lake City, UT 84119

(800) 877-1814

(801) 975-9992

fax: (801) 975-9995

**Circle 1146 on Inquiry Card.**

**CorelDraw 3.0** .....\$595

**Corel SCSI** .....\$99

Corel Systems Corp.

1600 Carling Ave.

Ottawa, Ontario,

Canada K1Z 8R7

(613) 728-8200

fax: (613) 761-9176

**Circle 1147 on Inquiry Card.**

**DeMystifiers** .....\$129

MicroQuill Software Publishing, Inc.

4900 25th Ave. NE, Suite 206

Seattle, WA 98105

(800) 441-7822

(206) 525-8218

fax: (206) 525-8309

**Circle 1148 on Inquiry Card.**

**Flashdrive** .....\$699

The BSE Co., Inc.

2152 North Fourth St.

Flagstaff, AZ 86004

(602) 527-8843

fax: (602) 527-1540

**Circle 1149 on Inquiry Card.**

**Mac PowerBook**

100 .....\$2199

140 .....\$3499

170 .....\$4599

**System 7.0** .....\$99

Apple Computer, Inc.

20525 Mariani Ave.

Cupertino, CA 95014

(800) 776-2333

(408) 996-1010

fax: (408) 974-6412

**Circle 1150 on Inquiry Card.**

**Mastersport 386SL** .....\$3299

**Mastersport 386SLe** .....\$3799

**Mastersport 386SX** .....\$2995

Zenith Data Systems

2150 East Lake Cook Rd.

Buffalo Grove, IL 60089

(800) 553-0331

(708) 808-5000

fax: (708) 808-4434

**Circle 1151 on Inquiry Card.**

**NCR Safari NSX/20** .....\$4199

Safari Systems

14K World's Fair Dr.

Somerset, NJ 08873

(908) 302-5800

fax: (908) 469-4578

**Circle 1152 on Inquiry Card.**

**Science Adventure** .....\$79.95

Knowledge Adventure, Inc.

4502 Dyer St.

La Crescenta, CA 91214

(800) 542-4240

(818) 542-4200

fax: (818) 542-4205

**Circle 1153 on Inquiry Card.**

**Windows Draw** .....\$149

Micrografx, Inc.

1303 East Arapaho Rd.

Richardson, TX 75081

(800) 733-3729

(214) 234-1769

fax: (214) 234-2410

**Circle 1154 on Inquiry Card.**



# The World's Best Selling UNIX Clone Just Got Better.

## Now with full 32-bit implementation!

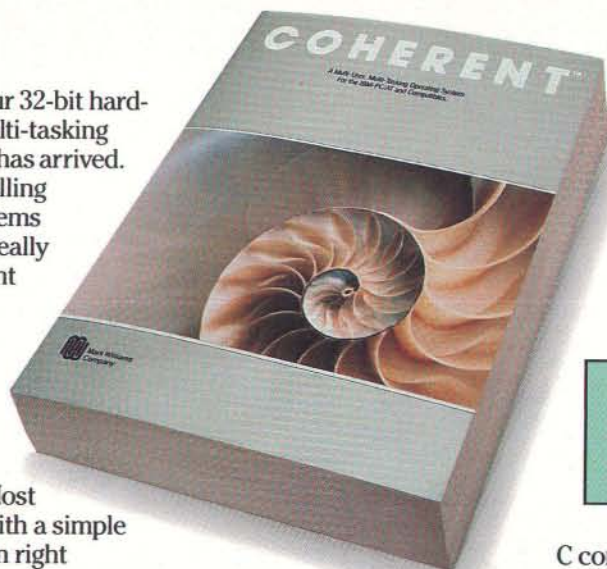
If you want to ignite your 32-bit hardware with the multi-user, multi-tasking power of UNIX, Coherent 4.0 has arrived. And if you're operating or selling small business network systems with dozens of users, that's really good news. Because Coherent 4.0 is what you want in UNIX at a price that's hard to believe.

## Run UNIX applications today!

Coherent is now binary compatible with UNIX. Most UNIX PC applications port with a simple recompile and many now run right out of the box. The list is growing everyday, so call for details.

## Yes, It's For Real!

How can it be? First of all, Coherent was independently developed by the Mark Williams Company, so you don't pay for UNIX licensing fees. You don't pay any mark-up or reseller costs either. Coherent is only sold directly to you.



six disk installation is a breeze compared to their 25. You'll also learn it faster and increase overall performance. All because Coherent is smaller, faster... and better.

## Small, But So Complete.

Make no mistake, Coherent is a wholly professional development system. You get a complete

*"Coherent comes so fully qualified as a UNIX clone, you find yourself thinking, 'I can't believe it's not UNIX.'"—Sean Fulton, UNIX Today!*

# Coherent.<sup>TM</sup> Still \$99.95.

C compiler, assembler and over 200 UNIX commands including full sets of functions for development, administration, maintenance and text processing.

Coherent also comes with UUCP capabilities that connect you to a world-wide network of free software, news and millions of UNIX users. And it's all clearly documented in Coherent's highly praised 1200 page manual.

## Experienced, Supported, Guaranteed.

Mark Williams Company has been developing professional programming tools since 1976. Our commitment to our products and users is unsurpassed. Users applaud our popular BBS and the widely acclaimed telephone support they get free from Coherent developers.

Still, we're not asking you to take a chance on Coherent. We've made it fool-proof to see for yourself—with a 60-day money-back, no hassles guarantee. So pick up that phone and order Coherent now. And the best way to UNIX will be on its way to you!

## 800-MARK WMS

(800-627-5967 or 708-291-6700, FAX: 708-291-6750)

## 60-DAY MONEY BACK GUARANTEE!



**Mark Williams Company**

60 Revere Drive, Northbrook, IL 60062

Coherent is a trademark of Mark Williams Company. UNIX is a trademark of USL.

*"...(Coherent) may be the best thing that has happened to UNIX yet."  
—William Zachmann, PC Week*

In fact, over 40,000 copies of Coherent have already been sold. And, like the ones we quote here, virtually every critic who's reviewed Coherent has raved about it.

## So Much Less, Yet So Much More.

As a virtual clone of UNIX, Coherent embraces the original UNIX philosophy: Small is beautiful. Small price, yes. But there's more, much more, to Coherent than its amazing price.

Requiring only 10 megabytes of disk space, Coherent can reside with DOS. So you can keep all your DOS applications and move up to Coherent. And it runs with as little as 1 MB of memory versus 4 MB for other UNIX versions.

## The World's Only Plug And Play UNIX Clone.

You'll have Coherent up and running with a fraction of the time and effort it takes for other UNIX versions. Our

	MWC COHERENT Version 4.0	SCO UNIX/386 Version 3.2V2
No. of Manuals	1	14
No. of Disks	6	25
Kernel Size	100 K	375 K
Install Time	40 min.	3-4 hours
Suggested Disk Space	10 meg	60 meg
Min. Memory Required	1 meg	2-4 meg
Performance*	85.7	31.3
Price	\$99.95	\$2590

\*Byte C Compiler Benchmark: Compiles per minute on 25 MHZ 486.





## When a bug showed up in a new program, the first to know was a guy in Montana. And everyone on CompuServe

Why settle for always being the last to know when you can be among the first with a CompuServe membership? We put an entire world of up-to-the-minute information right at your fingertips.

Our online, interactive hardware and software

support forums can put you in touch with thousands of experts: local, national, and international. Even the authors of new and popular software programs.

Whether you're a novice or an expert, there's someone out there who can help you with your





specific problems and concerns. Lend you expertise you won't find in any manual. Keep you on top of the latest developments. Or just give you someone to talk to who shares similar interests.

And there are libraries of software available for each hardware and software forum that you can download for free as a CompuServe member.

You'll find a lot more to talk about on

CompuServe, too. There are forums that can offer you help on just about everything: cameras, pets, model building, scuba gear—you name it.

So get CompuServe today. See your computer dealer, or call 1 800 848-8199, for information or to order. Outside the United States, call 614 457-0802.

**CompuServe®**

The information service you won't outgrow.



# Fast Transit

Slow slots? VL-Bus, PCI, and QuickRing will break system bottlenecks without walloping your wallet.

TREVOR MARSHALL

**F**or many applications, your personal computer is only as fast as your slowest component. That zippy CPU plays a constant game of "hurry up and wait" while your video card and hard drive controller, sitting in an 8- or 16-bit slot, pass along data at a fraction of its speed. A local bus can create a fast lane for peripherals by connecting them directly to the CPU. But because no local bus standard has existed, add-in card vendors have been unwilling to build products for the many proprietary local bus designs.

That's changing. Three local bus standards—VESA's (Video Equipment Standards Association) VL-Bus, Intel's PCI (Peripheral Component Interconnect), and Apple's QuickRing—promise to place performance of speed-critical peripherals such as video and storage on a par with that of today's fastest CPUs.

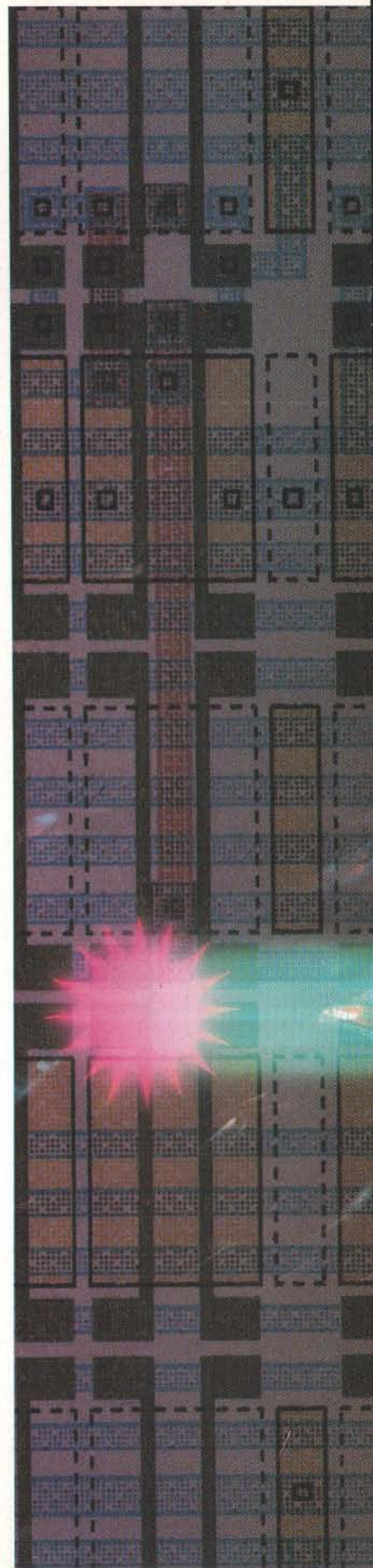
Tests performed in the BYTE Lab indicate that relatively low-cost VL-Bus video and hard drive controllers rival or beat today's best, more expensive offerings (see the text box "Putting VL-Bus to the Test" on page 124). The test results are even more dramatic when VL-Bus peripherals are combined with Intel's clock-doubled 486DX2 CPU: We saw a 50 percent increase in hard drive performance when we went from a 33-MHz 486DX CPU to a 66-MHz 486DX2.

For Intel-based PCs, VL-Bus is here now. An impressive lineup of system and add-in board makers have already announced their support for VL-Bus. By the time you read this, vendors such as Compudyne Products and Gateway 2000 will be selling VL-Bus PCs. Intel's PCI has also lined up solid support, including IBM and AST Research; despite reports of prototype systems, however, you may not be able to buy a PCI-based PC for about another 10 months. VL-Bus is the solution of choice—some say the short-term solution—among low-end vendors, while high-end, name-brand system vendors see PCI, a board-level local bus implementation, as the better-developed, long-term solution.

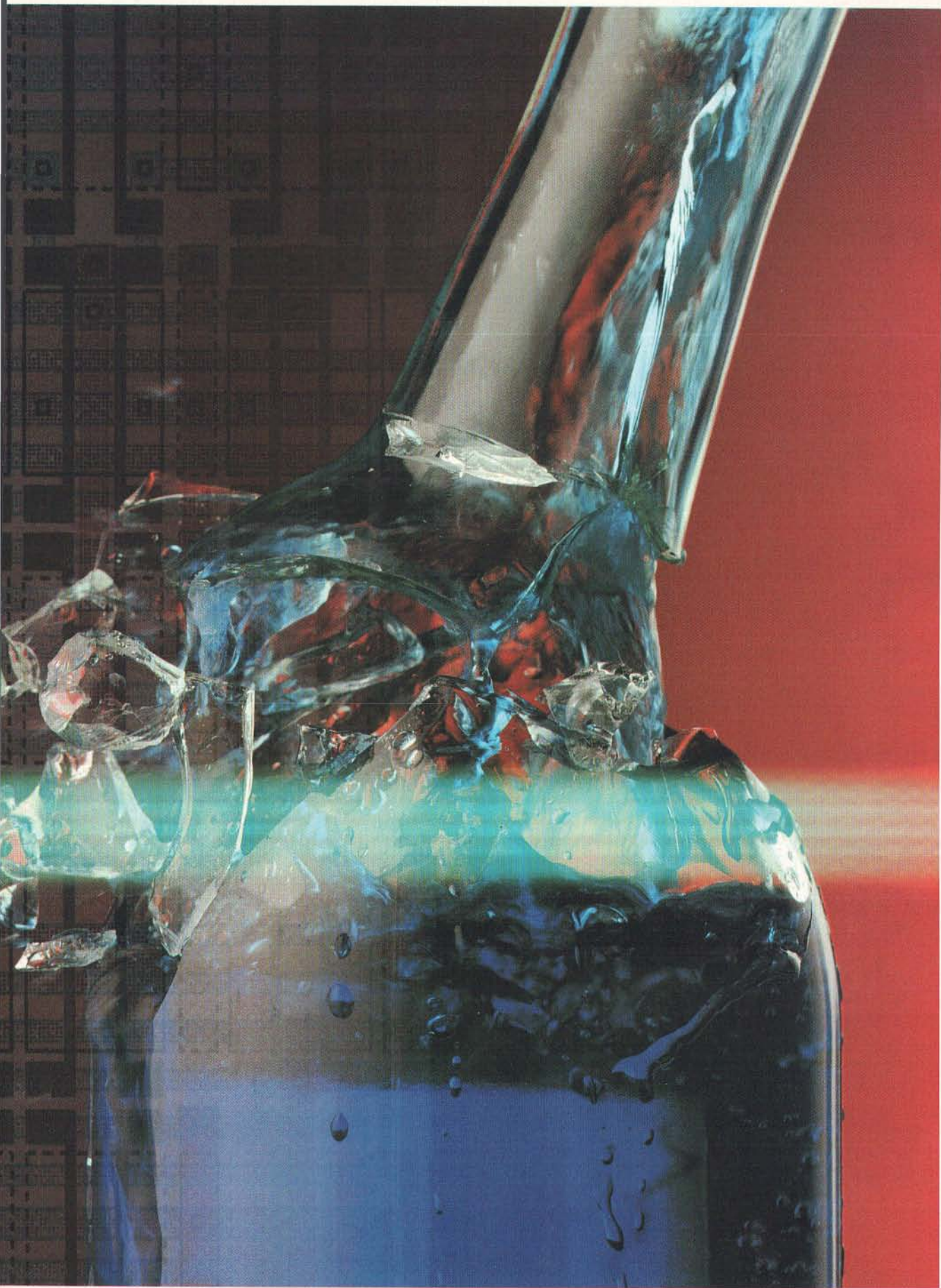
VESA expects VL-Bus and PCI to work together harmoniously. Intel is less optimistic, saying that VL-Bus risks overloading the CPU. Questions remain regarding the long-term viability of both standards, but given the need for a local bus standard now, at least one is certain to survive.

Meanwhile, Apple's QuickRing is a model of what the personal computer bus architecture of the future could look like. Borrowing concepts developed for supercomputers, QuickRing is three times faster than either VL-Bus or PCI. And it just might eventually find its way to your Intel-based PC.

*continued*









# Putting VL-Bus to the Test

STANFORD DIEHL

**W**ith all the promises being made, we were eager to put a preproduction VL-Bus motherboard through BYTE's benchmark suite to test its mettle. After all, the whole purpose of VL-Bus is enhanced performance. If the bus specification does not result in significantly speedier peripherals, no amount of hype will make it fly.

The testing detailed here is a preliminary look at VL-Bus. The components are engineering samples, so we can't make definitive assumptions. But strong performance is a promising indicator and should portend even better things to come.

Since VL-Bus vendors are in the early stages of developing for the new bus, the first products out of the gate will probably not represent the fastest implementations of the technology. It will take some time for vendors to iron out the kinks and develop adapter cards that take full advantage of the specification.

Our preproduction system is built from a Micronics VL-Bus motherboard and a 33-MHz 486 chip. Two key components take up the available VL-Bus slots: a Tseng Labs video adapter (a demonstration unit—Tseng Labs does not sell end-user products) and an UltraStor UL34F bus-mastering SCSI hard drive controller. For reference, we included the Compaq Deskpro 386/33L (our standard baseline machine) and the Compaq 486/33M, a high-performance 33-MHz 486

system with coprocessed video (see the benchmark graph).

We also obtained another piece of preproduction technology: an Intel 486DX2 66-MHz clock-doubler chip. This component added another twist to our testing, allowing us to explore how high-speed clock doubling works in conjunction with VL-Bus. All these pieces together make for an interesting set of benchmark results.

Our results suggest that there is very little performance difference between coprocessed video and VL-Bus video; in fact, the Compaq video board ran marginally faster. But VL-Bus video should cost a good bit less than a coprocessed solution. From these preliminary results, it appears that VL-Bus video will have an edge over coprocessed video when it comes to the price/performance ratio.

The UltraStor drive controller board displayed exceptional performance for a controller without a large hardware cache. We had no ISA-based version of the board to compare the VL-Bus performance to, but it is clear that the bus played a significant role.

## When You're Hot, You're Hot

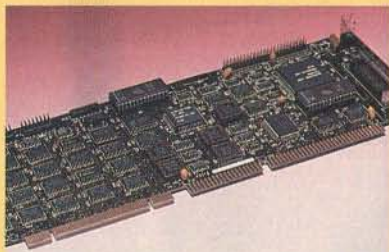
When we plugged the 66-MHz 486DX2 into the Micronics motherboard, our system really sizzled—in more ways than one. The chip quickly heated up to the point where it was impossible to touch without burning flesh. Again, the chip was a preproduction version, but it did make us take stock of the situation. That poor little chip was taking a whole lot of stress, burning along at 66 MHz and directly driving two peripherals at the same time. Intel's final version of the chip should handle the faster clock rate without overheating.

If vendors can run the 486DX2 reliably with VL-Bus, the payoff will be large. The clock-doubling chips limit the speed increase to CPU operations, and system performance is still crippled by a slow bus; in fact, the bus becomes even more of a bottleneck when the CPU is racing along at 66 MHz. The BYTE benchmark numbers clearly indicate that peripheral devices can take advantage of increased CPU clock speeds when connected directly to the CPU through VL-Bus.

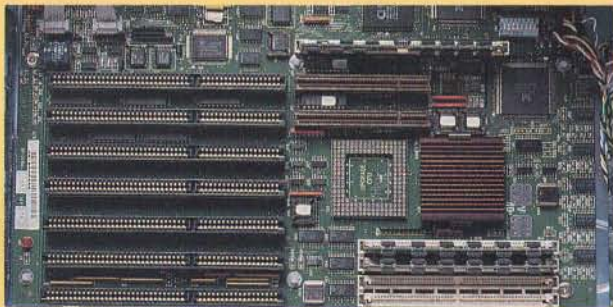
Our drive controller ran 50 percent faster with the clock-doubling chip installed. The increase in video performance was not as dramatic, but it was still significant. Despite Intel's lack of enthusiasm, VL-Bus may actually help boost the capabilities of Intel's clock-doubling technology—that is, if the heating problems are successfully addressed.

In the end, our benchmarks bear out the promise of VL-Bus. For mainstream applications, these performance gains may compare favorably to coprocessed video and hardware disk caches and cost less. VL-Bus looks like a winner.

*Stanford Diehl is a BYTE technical editor and former testing editor for the BYTE Lab. You can contact him on BIX as "sdiehl."*



**Photo A:** The Micronics VL-Bus motherboard shows a typical layout for the local bus slots. The VL-Bus extensions appear adjacent to the upper two ISA slots.



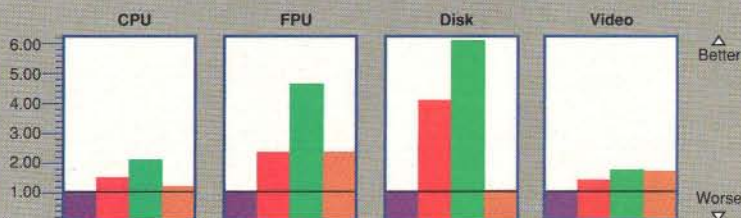
**Photo B:** The uncached UltraStor VL-Bus hard drive controller showed impressive performance, especially when coupled with the 66-MHz 486DX2 CPU.



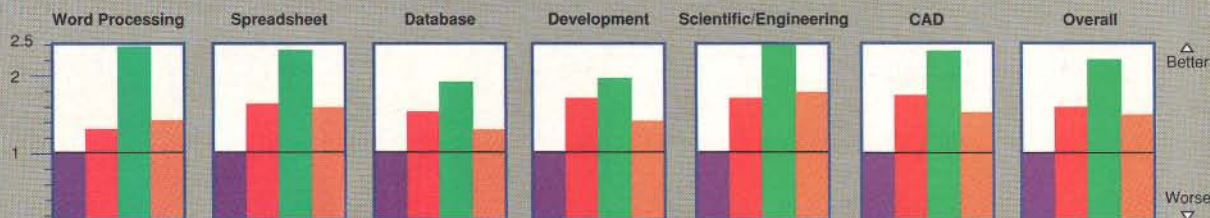
## BYTE BENCHMARK RESULTS

Compaq Deskpro 386/33
  Micronics without doubler
  Micronics with doubler
  Compaq 486/33M

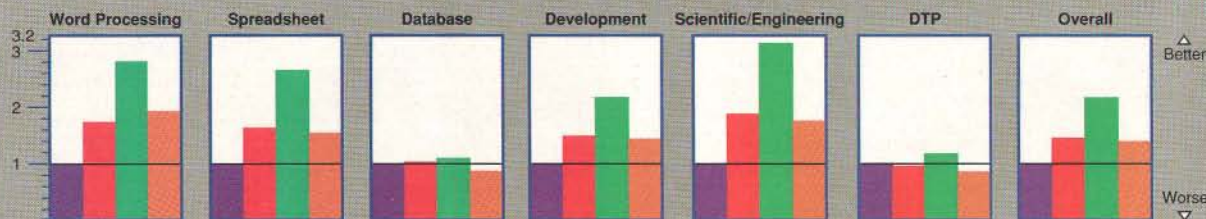
## DOS LOW-LEVEL



## DOS APPLICATIONS



## WINDOWS APPLICATIONS



All results are indexed, and higher numbers indicate better performance. For each index, a Compaq Deskpro 386/33L running Compaq DOS 5.0 and Windows 3.0 = 1. The overall index is the average index of each individual test.

The BYTE low-level benchmark suite identifies relative performance at the hardware level, breaking down performance by system component.

BYTE's application performance suite measures the performance you can expect to see running a given application category under a given operating environment. We test under two environments: DOS 5.0 and Windows 3.0. We test six application categories for each environment, running test scripts using the following programs: Word Processing: WordPerfect 5.1 and Lotus Ami Pro 2.0; Spreadsheet: Lotus 1-2-3 release 3.1+ and Microsoft Excel 3.0a; Database: Software Publishing Superbase 4 version 1.3 and Borland dBase IV; Development: Borland Turbo Pascal for Windows and Microsoft C 6.0; Scientific/Engineering: MathSoft Mathcad for Windows 3.0, The MathWorks MatLab 3.5k, and Computing Resource Center Biturbo Stata 2.1; CAD: Autodesk AutoCAD release 11; and Desktop Publishing: Aldus PageMaker 4.0.

*Preliminary benchmark results bear out the promise of VL-Bus. VL-Bus video held its own against the coprocessed solution of the Compaq, while UltraStor's VL-Bus drive controller displayed outstanding performance.*



# THE COMPAQ DESKPRO/i. SO A LIMITED PRICE LEAD

The company most qualified to advance the state of the desktop computer announces four systems that represent a breakthrough in R&D. At prices that won't ruin your P&L. Reflecting the level of thinking and quality that you've come to expect from Compaq.

At Compaq, there's a fundamental belief held by all of us that when you set extraordinary goals, extraordinary people will meet them.

Recently, for example, you made it clear to us that you wanted new PCs, with everything from advanced graphics to audio capability to affordable prices. Our response: the COMPAQ DESKPRO/i Family of PCs. Four new systems loaded with features to

enhance productivity.

The built-in COMPAQ QVision 1024 Graphics

times faster than most popular video graphic subsystems. So quickly, as a matter of fact, you may find your computer waiting for you. Instead of the other way around.

Its unique VersaChip Upgrade Architecture



Controller, for example, allows you to scroll, resize windows and pull down menus up to ten

ensures your PC won't be swept into obsolescence.

Simple chip upgradeability and a 64-KB cache

†This service is provided by contracted Service Providers and may not be available in certain geographic locations. Contact the Compaq Customer Support Center for further details. \*Suggested retail price; reseller price will vary; monitor not included; price indicated is for COMPAQ DESKPRO/i Model 84, not pictured here. © 1992 Compaq Computer Corporation.



# MUCH FOR THE IDEA THAT TO LIMITED THINKING.

memory module option  
provide quantum leaps  
in performance. Without

Intel 386/25, 386/33, 486SX/25,  
486/33, 486DX2/66 ◊ QVision  
accelerated graphics ◊ VersaChip  
Upgrade Architecture ◊ Integrated  
business audio ◊ 4 MB RAM (up to  
32 MB) ◊ Cache memory stan-  
dard ◊ 3 ISA expansion slots ◊ 3  
drive bays ◊ 84-MB to 510-MB  
hard drive options ◊ Multi-level  
security features ◊ Microsoft MS-  
DOS 5.0 as published by Compaq



similar outlays of cash.

The fully integrated  
audio system brings an  
unprecedented, yet not

unfamiliar dimension to  
mainstream business com-  
puting: your voice. The  
result of a collaboration  
between Compaq and  
Microsoft, it allows you,  
among other things, to  
actually paste voice mes-  
sages into spreadsheets  
and documents. Either as  
notes to yourself or as  
voice-mail across your  
entire network.

And we've engineered  
this breadth of technol-  
ogy right onto the PC's  
system board, preserv-  
ing the small footprint,  
large storage capacity  
and expansion of the  
COMPAQ DESKPRO/i.

Not to mention your  
financial integrity.

Add CompaqCare, a  
new service and support  
program with our free,  
one-year, on-site<sup>†</sup> lim-  
ited warranty. An Asset  
Management Provision  
that gives you and your  
network administrator a  
snapshot of your PC's  
configuration. And you  
have nothing short of a  
system that breaks a lot  
of new ground. Without  
breaking the bank.

For more detailed in-  
formation, just call us  
at 1-800-345-1518, ext.  
210 in the U.S., or call  
us at 1-800-263-5868,  
ext. 210 in Canada.

We bet you'll be as ex-  
cited about the COMPAQ  
DESKPRO/i as we are.



Our exclusive VersaChip Upgrade  
Architecture allows you to expand the  
COMPAQ DESKPRO/i PC from  
386/25 through 486DX2/66.



You can paste voice messages into MS  
Windows 3.1 documents with our  
integrated business audio system.



The COMPAQ DESKPRO/i PCs start  
at just \$1779.\* Our integrated  
QVision graphics offer "incredible  
performance—among the fastest we've  
seen for any system." —PC Magazine

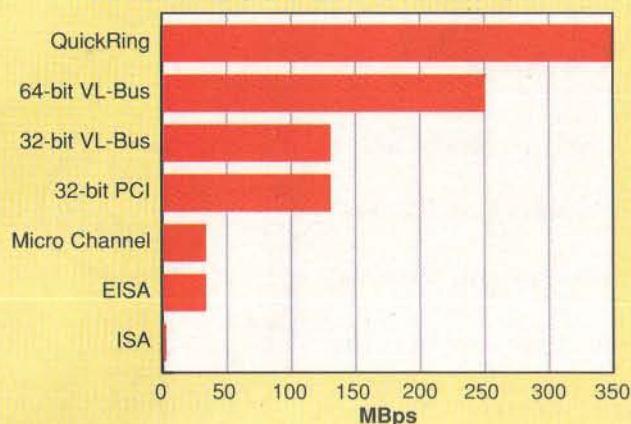


All Rights Reserved, COMPAQ DESKPRO Registered U.S. Patent and Trademark Office. CompaqCare and QVision are trademarks of Compaq Computer Corporation. Product names mentioned herein may be trademarks and/or registered trademarks of their respective companies. The Intel Inside logo is a trademark of Intel Corporation. PC Magazine, July, 1992.

Circle 85 on Inquiry Card.



# RATED BUS PERFORMANCE



**Figure 1:** The new local bus standards show a significant increase in their rated speeds versus established bus architectures. Few applications today require more than 100 MBps. However, as the complexity of applications increases, greater bus speed will be needed. Both VESA and Intel are confident that they can boost the performance of VL-Bus and PCI, respectively, to meet future demands.

## VESA's VL-Bus

The ISA, EISA, and Micro Channel buses have failed to deliver low-cost, high-speed operation to Intel-based PCs (see "System Bus or System Bottleneck?," March BYTE). As the individual components of a system become more powerful, the role of the system architecture—that framework that integrates components into a system—becomes more important. But the limits of a system architecture centered on a single, slow I/O bus have become increasingly apparent (see figure 1). The performance promised by succeeding generations of ever-faster CPUs became harder to achieve, while applications and peripherals were continuously demanding more performance. "The PC architecture of 1981 no

longer makes sense in 1992," says Michael Slater, editor and publisher of *Microprocessor Report*, an industry newsletter on microprocessor hardware based in Sebastopol, California.

VESA, a consortium of more than 120 companies, produced the VL-Bus specification as an immediate solution to the peripheral bus bottleneck. It works at speeds comparable to those of the Intel 386SX, 386DX, 486, or the upcoming P5 CPUs. It can be used with other processors, however. For instance, VESA claims that one company has designed a VL-Bus interface for the Mips R4000 RISC processor, allowing it to use relatively low-cost VGA and other video boards designed for the Intel-based PCs.

VESA has defined how each local bus signal will be generated, making it possible for a manufacturer to build one chip to the VL-Bus specification and have it work in all VL-Bus-compatible computers. VESA plans to certify compatibility between VL-Bus motherboards and peripherals (see the table below).

VL-Bus not only provides a standard interface for local bus chips situated on the motherboard, but also defines a slot concept that enables expansion boards to use both the high-speed VL-Bus and also the slower ISA, EISA, or Micro Channel buses concurrently (see figure 2). In fact, it is possible to build a card that plugs into the VL-Bus slots and uses signals from the slower I/O bus. For example, although VL-Bus handles all the high-speed signals, the interrupts and DMA channel handshakes that you need for a drive controller have not been provided. Thus, you can design a board that plugs into both the ISA and VL-Bus connectors, making all the needed signals available.

VL-Bus is not limited to video or drive controller boards. Any plug-in board that needs higher speed than the I/O bus can provide can use the VL-Bus slots to access the CPU directly. Both VESA and vendors warn, however, that VL-Bus is not necessarily a miracle cure for poor performance. For example, a coprocessed ISA video accelerator board could outperform a standard VL-Bus VGA card. Consequently, it would not be cost-effective to upgrade to an existing system simply to improve video performance. "Local bus helps overall performance, but it's not the ultimate," says Henry Quan, president of graphics card vendor ATI Technologies, based in Scarborough, Ontario, Canada.

Surprisingly, this performance enhancement has been achieved with only a modest increase in system cost. Dan Kikinis, president of Oakleigh Systems, the Santa Clara, California, R&D subsidiary of U.K. system manufacturer Elonex, says that because VL-Bus (or PCI, for that matter) requires virtually no glue chips, an add-in card that costs \$1000 to implement for EISA will cost only \$500 for VL-Bus. "VL-Bus and PCI will be the death of EISA," Kikinis says, adding that EISA's demise will take several years. VL-Bus also uses the standard low-cost connector that was developed for the 16-bit Micro Channel bus. "VL-Bus is as fast as you can get, and as simple as you can get," says VESA executive director Thomas Ryan.

Dean Hays, technical marketing manager at chip-set maker Chips & Technologies (Santa Clara, CA), says that the original intention of the VL-Bus specification was to make it possible to design boards with existing chip sets and a little glue logic. Once the VL-Bus specification was stable, Hays said, C&T would be able to incorporate all the extra VL-Bus logic right into the main chip set itself.

## COMPANIES THAT HAVE ANNOUNCED VL-BUS PRODUCTS

### Systems/motherboards

Advanced Integration Research, Inc.  
Alpha Research Corp.  
CMS Enhancements, Inc.  
CompuAdd Corp.  
Compudyne Products, Inc.  
DFI, Inc.  
Diamond Computer Systems, Inc.  
Digital Air Systems  
Elonex plc.  
Everex Systems, Inc.  
Genoa Systems Corp.  
Hyundai Electronics America, Inc.  
Micronics Computers, Inc.  
Nexgen  
Northgate Computer Systems, Inc.  
Oakleigh Systems, Inc.  
Point Corp.

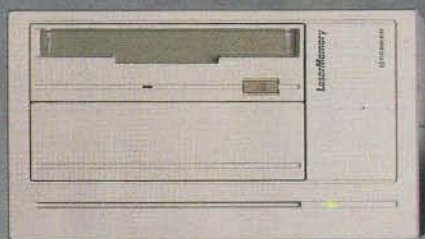
### Graphics adapters/controllers

Actix Systems, Inc.  
Advanced Integration Research, Inc.  
ATI Technologies, Inc.  
Diamond Computer Systems, Inc.  
Genoa Systems Corp.  
Matrox Electronic Systems, Ltd.  
Nexgen  
RasterOps Corp.  
Sigma Designs, Inc.  
STB Systems, Inc.

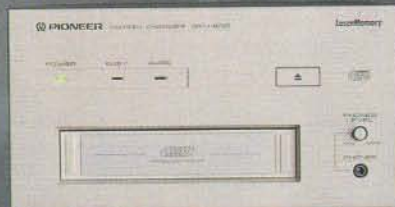
### Hard drive adapters/controllers

Alpha Research Corp.  
Data Technology Corp.  
Nexgen  
Point Corp.  
UltraStor Corp.

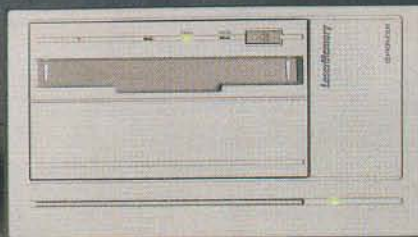




WORM  
(DD-S5101)



CD-ROM Minichanger  
(DRM-600)



Multifunction  
(DE-S7001)

# WE DIDN'T HAVE TO PUT OUR OPTICAL PRODUCTS ON PEDESTALS. JERRY POURNELLE DID.

**“** I am pleased to report that I'm sold. The Pioneer optical drive... is as solid as a rock... Thus, I'm discontinuing testing. Now I'll just use the drive... I now rely on the Pioneer erasable optical disks for backup, for primary storage of really big files, and for archive copies of software... you really need something so easy to use that you'll routinely use it for backup... the Pioneer DE-S7001 will do the job very well indeed. Recommended. *Byte* (9/91)

The Pioneer six-pack CD-ROM Minichanger is great. We've had it in operation for the best part of the year now, on a number of different systems... It has always performed flawlessly... it changes drives a lot faster than you'd expect it to... It's really fast... Accesses that used to take many seconds are now nearly instantaneous. Accesses that took over a minute now take a few seconds. I always did like the Minichanger... Now it's even better... Incidentally, the Pioneer Minichanger will work just fine with a Mac. *Byte* (10/91)

The Pioneer DE-S7001 dual-purpose external optical disk drive I've written about before. Log your wordprocessor to that, save early and often, and you'll have it all... In a word, WORM drives look like

the ultimate in backup storage. *Byte* (12/91)

Suppose you erase a file? Overwrite one you wanted to keep? And suppose your house burned down? You don't have any off-site backup at all... I could remedy that by installing the DE-S7001 on the network server and archiving on that... *Byte* (11/91)

I have the DRM-600 running not only with QEMM386.SYS, but inside DESQview windows, which has the amusing result that I can actually have several CD-ROM windows open at once... It's surprising how fast you can switch back and forth among them... The Pioneer DRM-600... it's very convenient to have a bunch of CD-ROMs available without swapping. *Byte* (1/91)

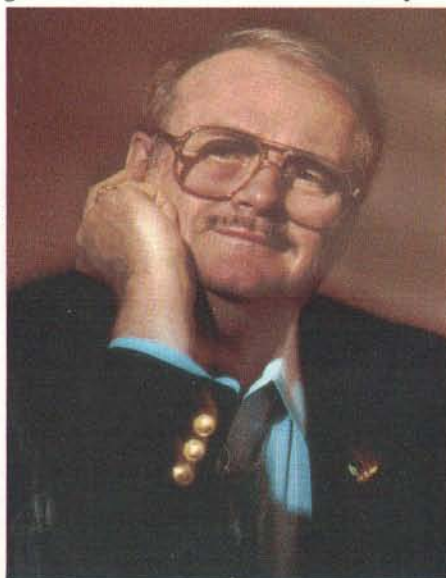
It's quite intuitive [the Pioneer CD-ROM Minichanger]: no instructions are required... Recommended. *Byte* (1/91)

This technology is coming of age. *Byte* (1/91) **”**

For more information or for a free VHS videotape "Pioneering The Future," about Pioneer optical disk products, call 1-800-LASER-ON, and find out why Pioneer is the leader in optical disk technology.

 **PIONEER®**

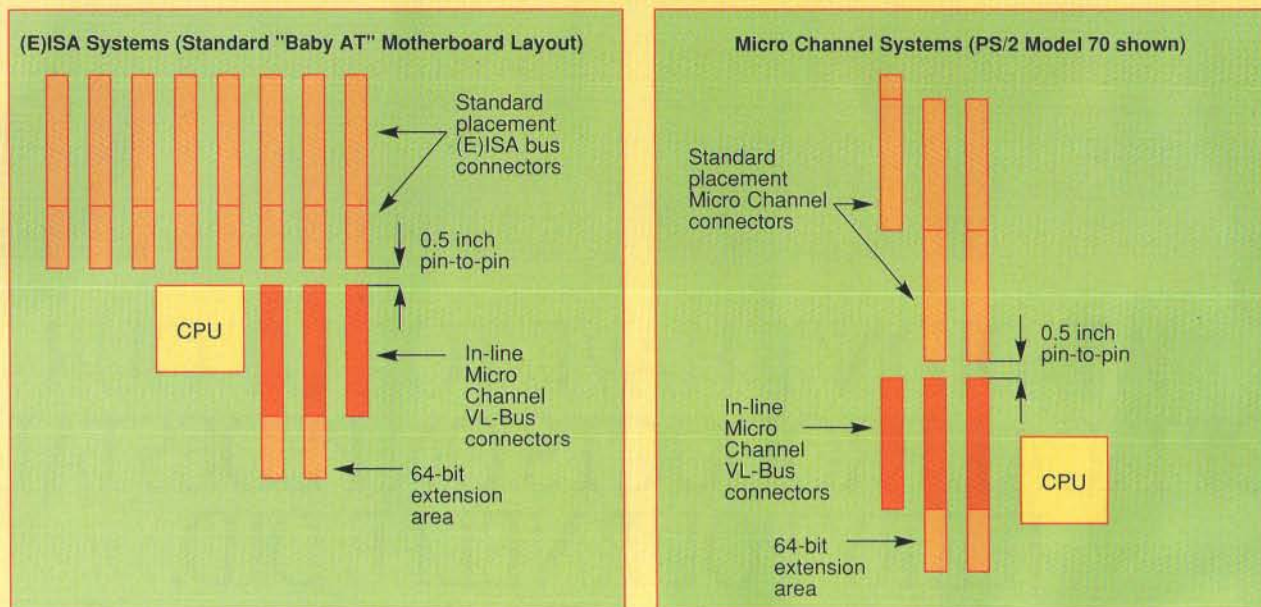
JERRY POURNELLE  
RENOWNED COMPUTER COLUMNIST



Pioneer DE-S7001, Pioneer DRM-600, and Pioneer DD-S5101 are trademarks of Pioneer Communications of America, Inc. QEMM386.SYS and DESQview are trademarks of Quarterdeck Office Systems.



## VL-BUS PHYSICAL LAYOUT



**Figure 2:** VL-Bus is a local bus intended to complement the capabilities of the current I/O bus. Consequently, the VL-Bus connectors are mounted in line with the existing I/O sockets. The (new) VL-Bus connectors carry all 32 data lines from the CPU, the 32 address lines, and the CPU's control signals. Additional lines provide the multimaster arbitration, the burst-transfer control signals, and the 16-bit steering logic. VL-Bus's data width can be extended to 64 bits to accommodate the next generation of CPUs.

Still, designing and building VL-Bus-capable cards is a challenge. Each of the VL-Bus boards has to be designed very carefully, with extremely short traces between the edge connector and the circuitry, and with extensive on-card buffering to relieve the load going to the CPU. These traces must be no longer than 2 inches and must have no more than one chip input connected to them. Quan says that VL-Bus simplifies his job, because ATI does not have to produce a discrete design for every proprietary local bus implementation. However, he adds, "If you're asking if it's easier to build a peripheral that runs at 33 MHz rather than 8 MHz, the answer is 'definitely not.'" At that speed, engineers have to pay closer attention to chip tolerances and specifications.

Designers are limited to a maximum of three VL-Bus slots on the motherboard. The CPU's pins can be directly driving the address, data, and some control signals simultaneously. Under these conditions, the CPU is just not capable of driving more than three external loads unless it is operating at a very low clock frequency. Thus, even though it is possible to have three VL-Bus-compatible slots in a PC, it may only be possible to have one or two slots at frequencies higher than 33 MHz. The slots may be directly connected to the CPU, or they may be buffered (buffering reduces the load on the CPU, since the signals are then driven by the buffers and not by the CPU pins). The frequency of the CPU (and hence VL-Bus) may be less than 33 MHz, or it may be greater than 50 MHz.

VL-Bus allows for up to three local bus masters. A VL-Bus master can take control of the system bus and move data to and from main memory, or to any board in the main I/O bus. For example, a VL-Bus master might be an intelligent storage controller or, conceivably, a second CPU. If there is a clash (e.g., if a VGA card is present in the VL-Bus slot and another is plugged

into the ISA bus), then the VL-Bus device will operate correctly and the ISA plug-in will be disabled.

### A Fuzzy Specification

Each VL-Bus system will be different, because the detailed motherboard implementation has been left to the PC designer. The benefit of such an unusually loose bus specification is to encourage the creativity of both add-in card and motherboard designers to achieve the maximum speeds possible in a PC. The specification lays a necessary framework to protect the computer buyer from the hazards of poor compatibility.

What each manufacturer has to ensure, however, is that no matter how many slots are installed, each of them must operate correctly when a VL-Bus-compatible card is plugged into it. Scott Vouri, a founder of graphics display developer Binar Graphics in San Rafael, California, believes that compatibility to the VL-Bus specification will boost competition among add-in board makers and, as a consequence, lower prices to the consumer. "The small guys can now participate in the marketplace," Vouri says.

It is even possible for the new low-power 3.3-volt logic devices to connect to VL-Bus, provided their inputs can withstand the peak 5.5 V that may come from the CPU. With a 3.3-V design, it's possible to lower the power dissipated at any given CPU frequency, allowing for faster clock speeds without an unacceptable rise in operating temperature.

The loose specification does leave room for incompatibilities to creep in, at least in early products. Richard Chen, product marketing director for Genoa Systems (San Jose, CA), a maker of motherboards and graphics cards, estimates that it will take about six months before manufacturers understand the specification





# Don't Shoot It, Troubleshoot It.

**LANDMARK... the widest selection of PC diagnostic software, firmware, and hardware in the world!**

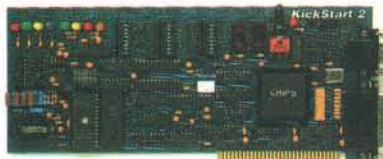
## PC WON'T BOOT? KICKSTART IT!

Don't replace your motherboard, use **KickStart 2™**. When serious hardware problems occur, nothing gets you up and running as fast. KickStart 2 *measures power within 2.5% on all four voltages, shows Power-On Self-Test (POST) failure codes, and features on-board ROM-based diagnostics* allowing you to determine and remedy the problem quickly, easily, and inexpensively!

Built-in serial and parallel I/O allows for testing remote via modem, or simply logging results to a remote terminal, printer, or laptop. You can configure your own test routines and store them in KickStart 2's battery backed-up CMOS RAM for quick future use. On-board switches, LEDs, and digital displays allow complete control over testing in systems lacking video or disk.

KickStart 2 is the ultimate **SECURITY CARD**, too. With two levels of password protection and pre-O/S activation, you can confidently prevent unauthorized use of your PC.

Includes serial and parallel loopback plugs and the Landmark **JumpStart™** AT ROM BIOS for testing ATs that don't issue POST codes. KickStart 2 works independent of your operating system. You can use it on DOS or UNIX systems. **CALL for current pricing.**



"The number of tests KickStart 2 can perform is mind-boggling... **IF THE KICKSTART 2 CAN'T FIND THE PROBLEM, IT PROBABLY EXISTS IN YOUR HEAD, not in the hardware.**"

Rich Santalessa, Computer Shopper

"KickStart 2 system diagnostics board helps users check out virtually every aspect of a PC's hardware system... **THE BOARD IS A WORTHY INVESTMENT** for computer maintenance."

David Claiborne, PC Week

## PROFESSIONAL LEVEL PC TROUBLESHOOTING

Landmark **Service Diagnostics™** is ideal for professionals requiring the most exhaustive diagnostic test capabilities.

Service Diagnostics is not just a single product, but a complete LINE of products. It's comprised of software, hardware, and firmware so you can choose the best "tool" for the job.

When your PC won't boot, you'll need **ROM POST** firmware, a plug-in chip that virtually "jumpstarts" the system to determine what's wrong. And, when your printer isn't working, you won't know whether it's the LPT port, cable, or printer without hardware, like our loopback plugs (which together with our software completely test the COM ports).

To provide you a complete troubleshooting resource, Service Diagnostics is offered in single modules or in "kits." Components include: CPU-specific software (PC, XT, AT, 386/486, PS/2), ROM POSTS (PC, XT, AT) and floppy alignment disks (3.5" and 5.25").

All the Service Diagnostics software modules are available in self-booting versions for use with non-DOS operating systems like UNIX.

Service Diagnostics is powerful and flexible. Hundreds of tests can be performed on your motherboard, memory, video, COM ports, floppy and hard drives, printer, and more. **CALL for a customized quote on the kit that's right for you!**

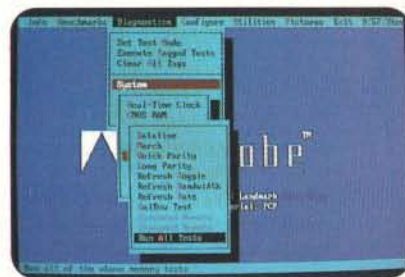


## PC DIAGNOSTICS MADE EASY

You don't need to be technical to use **PC Probe™**. With clear, intuitive, pull-down menus and 206 pages of on-line help, troubleshooting your PC is truly **MADE EASY!**

And, you don't have to be handy with a screwdriver to make PC Probe pay for itself. Just by providing a diagnostic report to your service and repair shop, you'll save money and receive quicker service.

PC Probe runs over 150 tests including: motherboard and CPU, memory, video card and display, keyboard, COM ports, floppy drive and controller, hard drive and controller, and more. Includes **VirusCure**, Landmark **Speed Test**, **AT SetUp** & loopback plugs. **CALL for current pricing!**



## SLASH HARD DISK SET-UP TIME

If you install, upgrade, or maintain hard drives, then you need **DiskBase™**. It'll save you boat-loads of time and money by putting the exact hard disk information you need at your fingertips... whenever you need it.

DiskBase reveals 12 technical specs on over 2500 hard disk drive models and 8 technical specs on over 220 controllers. Once you've located the correct hard disk model, you can instantly bring up a listing of all compatible controllers. **CALL for current pricing!**

- Toll Free Tech Support
- 90 Day Money Back Guarantee
- Federal Express Shipping

**CALL (800) 683-6696**

FAX (813) 443-6603 • Int'l (813) 443-1331

**LANDMARK**  
RESEARCH INTERNATIONAL CORPORATION  
703 Grand Central Street • Clearwater, FL 34616



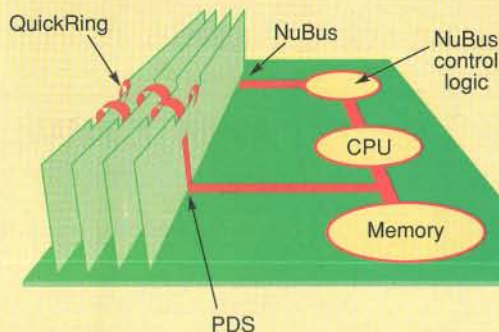
## THE 5 MINUTE SOLUTION TO FLOPPY DRIVE FAILURE

With **AlignIt™** you can clean, diagnose, and align your floppy drives in minutes without a scope. Patented technology requires only a screwdriver to perform ANSI-accurate alignments (.3 mils).

AlignIt is ideal for corporate users with multiple PCs. The **GOLD STANDARD** feature allows you to align all your PCs to the same in-house standard, guaranteeing that all your floppies are perfectly interchangeable between PCs! Available in 3.5" or 5.25" for both high and low densities. **CALL for current pricing.**



## THE QUICKRING LOCAL BUS



**Figure 3:** QuickRing is a local bus that connects the Mac's PDS to any board in the NuBus. The QuickRing architecture is identical to that of the VL-Bus, since the high-speed PDS interconnect taps directly into the CPU's signal lines and bypasses the slower NuBus control logic. Like the VL-Bus peripheral, a QuickRing card can have access to both the NuBus and the higher-speed QuickRing local bus.

well enough to ensure compatibility. Genoa's solution is to sell a VL-Bus motherboard and graphics card as a set to system vendors. "[Vendors] don't want to get a headache figuring out which board to use," Chen says.

Not surprisingly, since they are both based on the 80x86 control signals, PCI and VL-Bus are very similar. Ron McCabe, VESA Local Bus Committee chairperson, says that VESA will publish an application note on how to make a PCI device work as a VL-Bus slave as soon as the PCI bus is public. At this writing, however, Intel won't say when the details of PCI will be released. Intel agrees that the two standards could work together, but sees no reason why anyone would want them to.

### The Bus Doesn't Stop Here

VESA has defined a 64-bit-wide data bus version of VL-Bus, rated—theoretically—at 250 MBps, in anticipation of the next generation of Intel microprocessors (which are widely rumored to have a 64-bit data bus). A different Micro Channel connector (the same connector that brings Micro Channel to 32-bit operation) provides the 32 new bits of data bus.

But even this performance boost does not compensate for what many see as the fundamental flaw of VL-Bus: It still relies on an obsolete, 11-year-old PC system design. VL-Bus is important because it solves the bus bandwidth problem for the short term. With PCI, Intel has taken a longer view.

### Intel's PCI

Intel's PCI architecture accepts the fact that the standard PC design is running out of gas. This interconnection standard clearly intends all high-speed peripherals to be mounted on the motherboard. "PCI is an intermediate foundation for next-generation PCs," says Slater.

According to Mike Bailey, PCI market-

ing manager, Intel does not encourage people to put cards right on the CPU bus. While it is true that the output signals of the 80x86 are not designed to drive the heavy loads usually associated with a bus and card structure, the VL-Bus specification has been carefully crafted to ensure that no damage is possible. At this point, the debate becomes political.

The PCI standard defines an interconnect topology that does not allow for user upgrades or for participation by innovative (but poorly funded) peripheral manufacturers. Although anybody can design a board that plugs into a VL-Bus connector, to participate in PCI you need to have the resources to design an application-specific IC to drive the interconnects, and this involves an investment of over \$100,000. Therefore, it is in the best interests of add-in board vendors and low-end clone makers to support VL-Bus. Larger, name-brand system vendors who rely on technical innovation and component integration naturally favor PCI.

Genoa's Chen expects a lot of system vendors to use VL-Bus "as long as they have common sense." He says that VL-Bus adds value to a system and lets vendors maintain their profit margins. He says that for an additional \$10 to \$20 on the cost of the motherboard, VL-Bus provides enough of a performance boost to allow vendors to maintain profit margins while keeping their products competitive.

Elonex plans to use PCI in its high-end line of PCs and VL-Bus in its low end, according to Kikinis, with VL-Bus systems appearing first—perhaps within a couple of months. He sees PCI-based machines as about 10 months away from shipping, although some vendors might show prototype PCI systems at Comdex this November.

In an effort to gain acceptance of the PCI standard, Intel has invited system and peripheral board vendors to join a PCI special-interest group. The SIG's mission is to establish a PCI slot standard, which would alleviate the fears of board vendors who see PCI as a threat to their future, as well as those of system vendors who don't have the resources to fully integrate PCI on the motherboard.

The SIG "gets Intel out of a political tight spot," says Slater, because it places the burden of setting standards on a group of vendors. However, he believes that not coming out with a PCI connector standard immediately is "a huge mistake," because it gives VL-Bus the opportunity to establish itself.

## Key Points

### VL-Bus

- Here now
- Inexpensive to implement
- Limited scalability
- Loose specification (allows for vendor innovation)

### PCI

- Less stress on CPU than with VL-Bus
- More future-looking design
- Better tested; more robust

### QuickRing

- Fastest by far
- Most advanced design
- Allows for transfer among add-in boards

### The Speed Issue

PCI's maximum operating frequency is 33 MHz. Since PCI is a synchronous bus (i.e., each operation on the bus is performed in synchronization with the CPU clock), it is unclear how PCI peripherals will migrate to 50 MHz. According to David Carson, a PCI architect designer, Intel plans to deal with the speed differences with fractional phase-lock loops (circuits used to synchronize different clock frequencies).

Although phase-locked loops may be able to synthesize the 33-MHz PCI bus from a 50-MHz CPU clock oscillator, they will not be able to overcome the wait states (and the subsequent performance degradation) that will take place while the slower 33-MHz PCI peripheral is getting the data for the faster 50-MHz CPU; how this will affect performance, however, is not clear. A 66-MHz 486DX2 chip will run satisfactorily,



# A solution tailoured for perfect text recognition.

## The question is ...

If you are looking for a solution that will put an end to all those unnecessary hours of re-keying the already printed copy, and a technique that will also be able to retrieve the copy and edit it. And whilst doing this be cost-effective, accurate, fast, versatile and efficient, then look no further.

## We have the answer ...

Hewlett-Packards ScanJet IIP scanner with HP AccuPage Technology and Recognita Select.

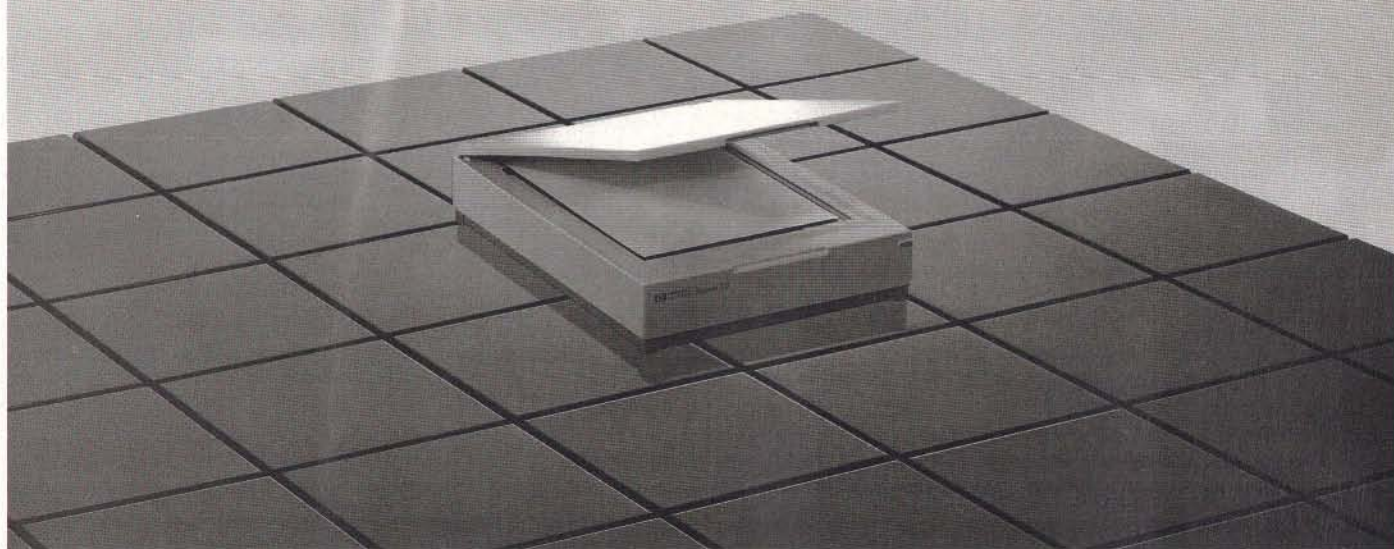
HP ScanJet IIP with HP AccuPage is optimized for OCR (optical character recognition). HP AccuPage sets intensity automatically to deliver the highest quality image and clears the background of text from any stains or trash delivering sharp and well defined character shapes for Recognita Select OCR software. HP AccuPage technology used with Recognita Selects multilingual text recognition abilities make a superb combination that simply meets every demand.

and systems tha  
Recognita Select  
dems achieve th

Scanned image without HP AccuPage technology

and systems tha  
Recognita Select  
dems achieve th

Scanned image without HP AccuPage technology



**SZKI Recognita Corp.**

Tel: (36-1) 201-8452  
Fax: (36-1) 201-7607



**Recognita Corp. of America**

Tel: (408) 241-5772  
Fax: (408) 241-6009



**HEWLETT  
PACKARD**

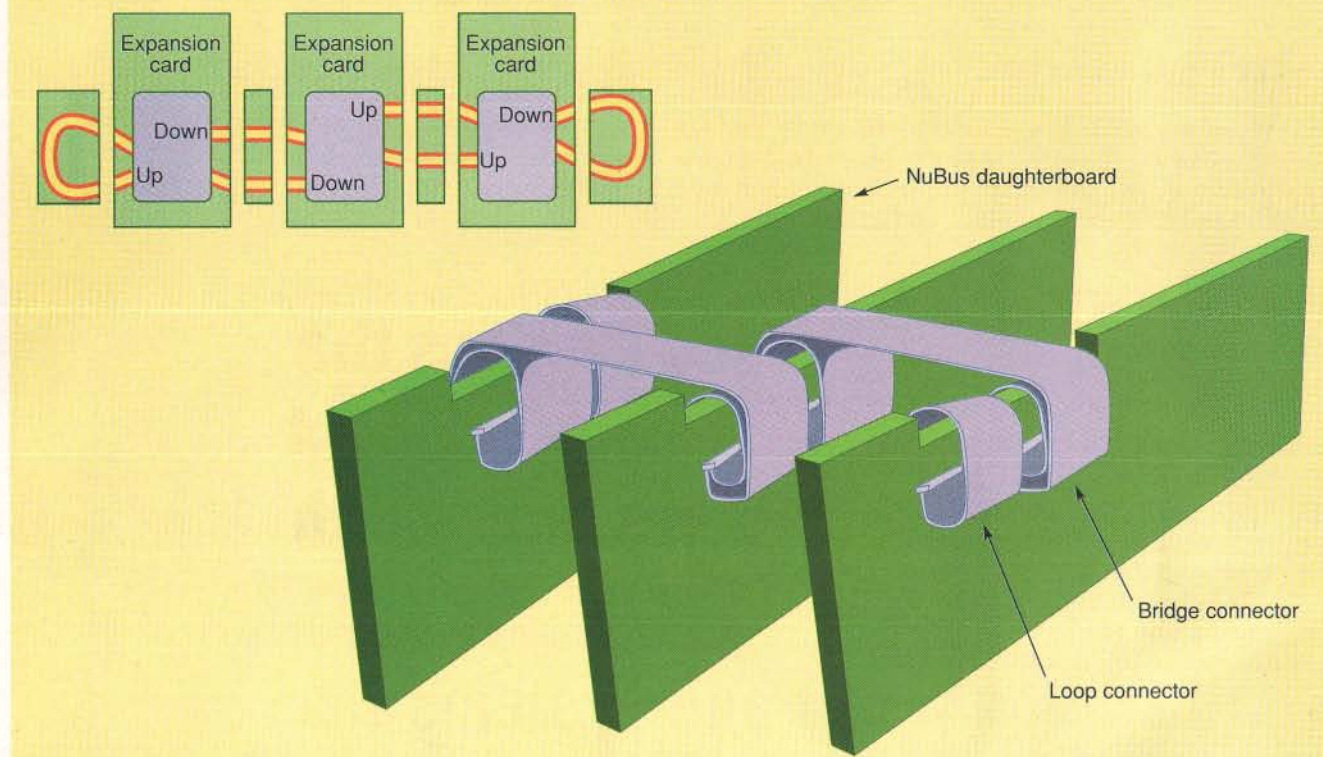


Tel: 415-692-9061  
Fax: 415-692-9064

Circle 161 on Inquiry Card.



## TWISTED-RING TOPOLOGY



**Figure 4:** The twisted-ring interconnect topology ensures that data has to travel through only two connectors and one card before encountering a receiver. The QuickRing circuitry takes only 4 square inches of board space, including the 140-pin National Semiconductor interface chip.

because its external bus is run at exactly half the chip's 66-MHz clock frequency; but how will a 100-MHz 486DX2 CPU interface with PCI peripherals?

This anomaly is unusual, as PCI is otherwise a robust local bus specification. Intel spent over 2000 hours in computer simulations of the PCI bus using the SPICE (Simulator Program for Integrated Circuit Emulation). Carson insists that, as a result, the best design was chosen. "By the time we were finished, I was sure that the PCI specification was solid," he said, adding that PCI will support the peripheral interface speeds for both today's microprocessors and those coming along during the next few years.

In a manner somewhat reminiscent of EISA and Micro Channel, PCI chips have unique identification numbers. The system BIOS will interrogate the PCI peripherals at power-on to see what PCI devices are present and then execute code that will be able to use the unique features of each device.

PCI has one set of 32 pins for carrying both the address and data lines to the peripheral devices; VL-Bus, on the other hand, has 64—32 for data and 32 for addresses. Since the cost of a chip increases as its pin count rises, larger vendors who typically place video and drive controllers on the motherboard are likely to favor PCI over VL-Bus.

#### Apple's Revolutionary QuickRing

Local bus developments have not been limited to PCs using Intel-compatible CPUs. Apple has for some time provided a Processor Direct Slot in its Mac II range of computers. The PDS enables a plug-in card to directly access the pins of the 680x0 and

pass data to and from the CPU at very high speed.

The main problem with the PDS, and one of the reasons that so few cards support it, is that it is machine dependent. Every Mac seems to have a different PDS connector—one for the pin-out of the 68020 CPU, one for the 68030, and the newest one for the 68040. To address this situation and to produce a very high-speed local bus, Apple has developed QuickRing, a local bus designed to couple the PDS to each expansion card in the (NuBus) I/O bus (see figure 3).

But QuickRing has so many technical innovations and such a high processing speed (up to 350 MBps, or three times the speed of either VL-Bus or PCI) that it is conceivable that it (or something like it) will someday find a home in Intel-based PCs as well. Currently, QuickRing is the only way to pass data between cards at these high speeds. If some of the cards were in Macs and some were in Intel-based PCs, the QuickRing would become like a high-speed LAN, linking the two computers and allowing a developer to use the best features of each environment.

Jim Potter, director of engineering at Yarc Systems (a supplier of RISC graphics coprocessors), expects QuickRing to revolutionize desktop publishing. "I can see a system," he says, "where the PostScript RIP is running on a 486 PC while the actual page composition and editing are performed on a Macintosh." QuickRing will allow the high-speed transfer of graphics and images between the two machines.

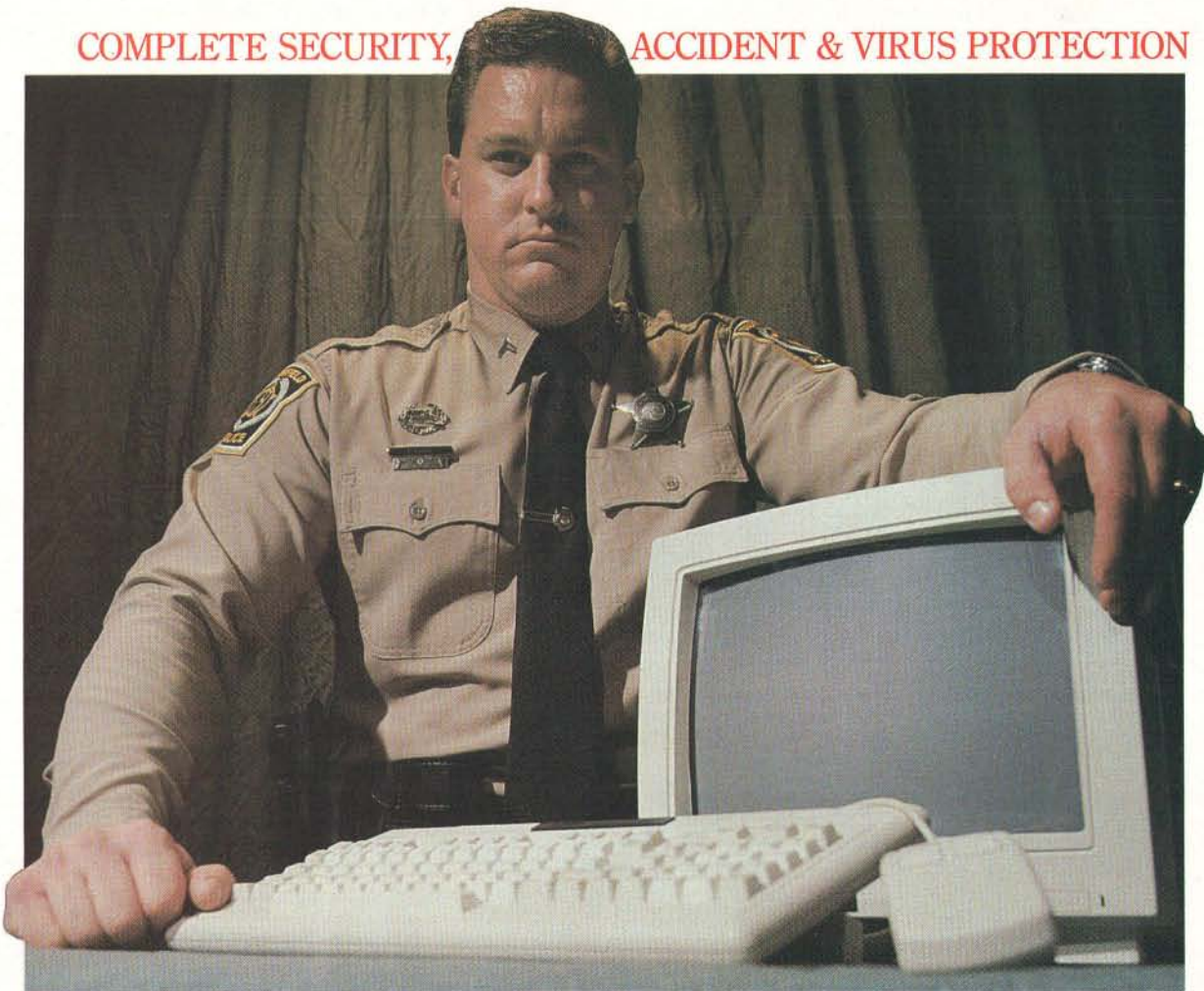
#### QuickRing's Supercomputer Heritage

QuickRing's twisted-ring topology (see figure 4) is one of two innovations that stand out most clearly. The other is the use of



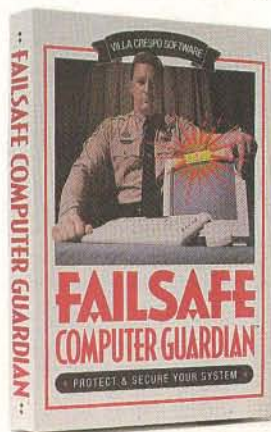
# Close the Windows. Lock the DOS.

COMPLETE SECURITY, ACCIDENT & VIRUS PROTECTION



## Failsafe Computer Guardian.™

Complete Protection At A Sensible Price—\$59.95



Look for the box with the  
**Failsafe Beacon™**

Guard valuable files and programs. Never again delete or change anything accidentally. Keep out snoops, thieves, vandals. And prevent virus attacks. All at one low price!

- Easy enough to use at home
- Supports DOS, Windows and Networks in one single package
- Indispensable for government, business and power-users
- Allow selective access by user, function or file

Available at leading software stores everywhere!

For more information, call 1-708-433-0500 or Fax 1-708-433-1485

Villa Crespo Software

1725 McGovern Street, Highland Park, Illinois 60035

© 1992 Villa Crespo Software, Inc. • All products mentioned are Registered Trademarks of their respective companies



MADE IN USA

End Users circle 224; International circle 225; Dealers circle 226 on Inquiry Card.



low-voltage signals on a flexible bus that acts like a perfect 50-ohm transmission line.

The ISA, EISA, Micro Channel, VL-Bus, and PCI architectures all work with TTL-compatible logic signals. These signals swing from a logic low of around 0 V to a logic high greater than 2.4 V. Any bus using these signals has to be quite high-impedance in order to cut down the power consumed to a level that standard logic devices can handle. For example, if the 50-ohm QuickRing interconnects were to be run at these logic levels, the peak power consumed by each data line would be 0.5 watts. The 32 lines of the data bus would then dissipate at around 16 W, and the 32 address lines at another 16 W. Clearly, this would call for some form of liquid cooling of the CPU and for every other chip connected to the bus.

But National Semiconductor (Santa Clara, CA) has applied the chip technology it developed for the U.S. Navy's FutureBus to solve this problem for Apple. A very low voltage is used on each of the signal lines—much less than 1 V peak-to-peak. Special sensitive (and yet high-speed) input amplifiers sense these voltages and convert them to the TTL level that the chip uses to interface to logic on the add-in board. Only the signals transmitted over the bus are low-voltage, and it is not possible to connect the bus signals to any chips other than the special QuickRing drivers.

Beta Phase (Menlo Park, CA), which designs interconnects for supercomputers and the aerospace and defense industries, taught Apple how to interconnect cards using these high-speed circuits. Hal Kent, a designer at Beta Phase, says that QuickRing is the first personal computer bus capable of using these high-speed cables and connectors, also used in Cray supercomputers, efficiently.

The cables are made from layers of copper and flexible polyimide plastic. The signal traces are etched out of the copper in much the same way that a printed circuit board is manufactured. These cables can carry data at the full 180-MBps rate with minimal degradation in the signal quality. And they do it inexpensively: According to Apple, QuickRing will add \$20 to the cost of building a system, plus another \$5 for the connector. Controller chips and connectors are expected to be available early next year.

### The Bandwidth Issue

Although QuickRing will transfer up to 350 MBps, no single CPU or peripheral could use all that bandwidth at once. But Apple's twisted-ring topology allows several data streams to simultaneously "flow" between boards. Thus, a drive controller could be pulling an image off a disk and sending it to the video memory at the same time that another part of the video memory was sending its data to a video compression chip. Each peripheral on the QuickRing appears as a *node*. To send a data stream from the CPU to the video controller, the CPU opens up a *channel* with a *token*. It then sends data tokens (or bytes) over the QuickRing whenever it has data to send.

This is why comparing data transfer rates of different local buses is so difficult. If the data is, for example, coming out of a buffer in main memory and going straight into the video card, then the data transfer rate could be quite high, but still not equal to the 130-MBps peak bus rate of VL-Bus and PCI.

This is what happens when the CPU sets up what is referred to as a *burst transfer* from a VL-Bus device. Once the transfer has been initiated, the first data word does not get back from the memory until two clock cycles later. At 33 MHz, this first transfer has taken 60 nanoseconds to complete, which equates to a data transfer rate of a mere 67 MBps. On successive transfers, however, the data words are read on successive clocks at the full

132-MBps data transfer rate.

On the other hand, if the CPU is calculating the pixels to be displayed (as with a GUI) and sending them one by one to the video card, then the data would not be of a burst nature, but would come in little chunks every now and then. In this case, the VL-Bus speed would be less than 67 MBps. PCI behaves in the same way (as do EISA and Micro Channel).

With QuickRing, the situation is more complex. The overhead in setting up a single transfer is extremely high, since you have to open channels and manipulate tokens, so QuickRing will certainly not transfer single pixels at the full 180-MBps one-way data rate. However, once the first transfer has been initiated, successive data can be transmitted at speeds much closer to the ring's theoretical limit.

### More Speed to Come

Graphics and multimedia have an insatiable appetite for bus bandwidth. Now that display manufacturers can provide fast 640- by 480-pixel VGA displays, user demand has grown for even bigger and better displays. The bus bandwidth required for a 1024- by 768-pixel image is 2.5 times greater than for a VGA screen.

Local buses such as PCI and VL-Bus offer higher speed than EISA, Micro Channel, or ISA, but it will be hard to extend either of these local bus approaches to speeds higher than currently planned. Both VESA and Intel, however, are confident that their respective bus architectures can evolve to meet future needs. This raises the question, "Is more speed on the peripheral bus really needed?"

"If we can get faster buses, we can produce faster displays," says ATI's Quan. Slater, on the other hand, believes that both VL-Bus and PCI will be viable for the foreseeable future. "Even running NTSC video, either bus will have substantial bandwidth left over," he says.

For the short term, and perhaps longer, both VL-Bus and PCI should serve the needs of most users of Intel-based PCs. They represent a very cost-efficient way of meeting the performance demands of today's graphics-oriented applications and high-speed hardware. However, Quan, among others, cautions against automatically accepting any local bus as the ideal solution. "A lot of people are looking at local bus as being the messiah for graphics," he says. Quan suggests weighing all the options, including ISA, against your needs before making a decision. A coprocessed ISA video board or cached hard drive controller might prove more cost-effective than buying a VL-Bus system to save money on the add-in cards.

QuickRing, with its use of supercomputer technologies, offers a glimpse at how the highest-speed computer cards will interconnect in the future, using transmission-line cables carrying very low voltage signals. Apple is clearly taking no chances; whatever the demands of tomorrow's applications, QuickRing should be able to handle them. It still remains to be seen whether the marketplace as a whole will embrace advanced technologies such as QuickRing or just continue to load the CPU down with more and more local bus peripherals. ■

*Editor's note: Also contributing to this story were Andy Reinhardt, BYTE's West Coast bureau chief; Patrick Waurzyniak, Tom Halfhill, and Ed Perratore, BYTE news editors; Andy Redfern, BYTE's London bureau chief; and Michael Nadeau, a BYTE senior editor.*

*Trevor Marshall is a BYTE consulting editor and founder of Yarc Systems, a vendor of coprocessor boards in Newbury Park, California. You can reach him on BIX as "tmarshall."*



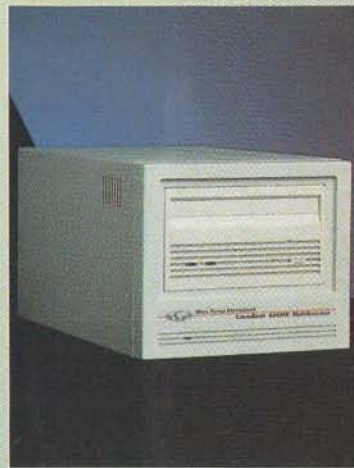
# Why settle for OPTICAL SPEED OR OPTICAL CAPACITY, When you can have BOTH!



The LaserBank Library 5-16DX multifunction optical jukebox is the fastest desktop jukebox available.

The new LaserBank Library 5-16DX optical jukebox contains the LaserBank 600MX drive, combining the fastest seek time (27ms average) with 10 GB of optical storage, and is available for AIX, DOS, Novell NetWare 386, and OS/2.

The MicroDesign LaserBank 600MX multifunction drive is available as a standalone internal or external drive, and is incorporated within the LaserBank Library 5-16DX.



## CONTACT THE DISTRIBUTOR NEAR YOU

ENELUX: RME (31) 36 5334636  
K, EIRE: Ideal Hardware (44) 81 390 1211  
GERMANY, SWITZERLAND, AUSTRIA: T.I.M. (49) 611 27090  
FRANCE: Opus Technologies (33) 1 46054079  
AUSTRALIA: SCSI CORPORATION (61) 2 550 4833

Spain: PROCO (34) 1 4165700  
Portugal: ESDI (35) 11 7979491  
Italy: GIGATEK (39) 45100370  
GREECE: INTELECT (30) 1 647 4481  
S. Africa: STARLAN (27) 11 804 4701



## Micro Design International Inc.





# SOFTLINE® THE BEST BUYS IN OVER 170 COUNTRIES.

## S O F T W A R E

\* (Items in RED run under Windows)

### Word Processors/Editors

Ami Pro 2.0	\$307
Brief 3.1	169
Fastgrabber 1.0	101
Grammarly IV 2.0	58
Justwrite 2.0	166
Microsoft Word 2.0 for Windows	319
Microsoft Word 5.5	223
WordPerfect 5.1 for DOS	274
WordPerfect 5.1 for Windows	282
Wordstar 7.0	274

### Project Management

Microsoft Project 3.0.1/Windows	461
Superproject 2.0	550
Timeline 1.0	465

### Database & Tools

Askam 5.0	219
Btrieve 5.10 for DOS	414
Btrieve 5.10 for OS/2	405
Btrieve 5.10 for Windows	412
C-tree Plus 1.0	451
Clarion Professional Dev 2.1	468
Clipper 5.01	519
Database 4.24	538
DBase IV 1.5	504
DBase IV Developer Edition 1.1	899
Libran/Windows 1.7C	397
DBXL 1.3R	133
Foxpro 2.0	489
Paradox 2.0 for OS/2	518
Paradox 4.0	514
Q&A 4.0	265
R-base 3.1	483
R-base 3.1 for OS/2 1-3 User	554
Superbase 4 Windows rel 1.3	480

### Statistics

SPSS PC+ Adv Statistics 4.0	254
SPSS PC+ Base Package 4.0 (DOS)	168
Statgraphics Plus	981

### Desktop Publishing

Aldus Type Manager 2.0	\$63
Aldus Persuasion 2.1	335
Aldus Photostyle 1.1A	337
Arts & Letters Graphics Ed 3.12	342
Facelift 1.2	60
Microsoft Publisher 1.0	132
Pagemaker 3.01 for OS/2	532
Pagemaker 4.0	532
PerForm Pro Design-Filler 1.0	182
PFS:First Publisher 3.0	89
Publishers' Type Foundry 1.5	322
Ventura Publisher Gold 4.01	537

### Graphics

Adobe Illustrator 1.1	369
Adobe Streamline 1.1	124
Applause II 1.5	353
Charmie 2.1	335
Corel Artshow '91 - CD NA	43
Corel Draw 2.0 for OS/2	384
Corel Draw 3.0	472
Designer 3.1 for OS/2	427
Designer 3.1 for Windows	428
Drifox Cad for Windows 2.0	292
DrawPerfect 1.1	360
Freelance Graphics 1.0 for Windows	335
Freelance Graphics 4.0 for DOS	337
GEM/3 Presentation Team 2.0	424
Harvard Draw 1.0	427
Harvard Graphics 1.0 for Windows	413
Harvard Graphics 3.0	124
Hipack 1.0	414
Microsoft Powerpoint 3.0	327
Windows Draw 3.0	101

### Spreadsheets

Lotus 1-2-3 rel 1.1 for Windows	427
Lotus 1-2-3 rel 2.4	354
Lotus 1-2-3 rel 3.1+	428
Lotus 1-2-3 for OS/2 1.1	513
Microsoft PC Excel 4.0	322
Quattro Pro 4.0	324

### Desktop Environments

Designview 386 2.4	\$133
HP New Wave 3.0	108
Microsoft Windows	95
Sidekick 2.0	58

### Project Management

Microsoft Project 3.0.1/Windows	461
Superproject 2.0	550
Timeline 1.0	465

## H A R D W A R E

### Display Boards

ATI Graphics/Ultra w/1MB (PCA)	\$488
Diamond Stealth VRAM w/1MB (PCA)	267
Hercules Graphics Sm w/1MB (PCA)	489
Orchid Fahrenheit 1280 w/1MB (PCA)	297
Paradise Acal Cad f/Win w/1MB	217
STB Wind/X Ultra w/1MB (PCA)	296
Video 7 WIN.VGA w/1MB (PCA)	171

### Emulation Boards

AST 5251-11 Enhanced Plus (PCA)	505
DCA IRMA 3 Convertible (PCA)	430
Xircom Pocket 3270 Adapter f/Win	551

### Facsimile Hardware

Boca Bocalfax 9624 Internal (PCA)	79
Complete PC Communicator	309
Complete PC Fax Part (9600)	309
Intel Satisfaction Classic (PCA)	338
Megahertz Fax/Modem 96/96 S/R Ext	495

### Printers & Accessories

Canon Bubblejet Printer B110EX	354
HP Deskjet 500C Color Printer	756
HP Laserjet III	1,627
HP Paintjet Color Printer	756
Pacific 25-In-One (all HP models)	273
Pacific 2MB Exp (2P, 3P, 3, 3D)	131
Pacific 4MB Exp (2P, 3P, 3, 3D)	221
PacificPage PS Cart (2P/D, 3/3P/D)	298

### Multimedia

Asymetrix Multimedia Toolkit-CD 1.5	\$513
MS Multimedia Beethoven - CD 1.1	53
MS Multimedia Bookshelf - CD 1991	129
MS Multimedia Dev Kit - CD 1.0	320

### OCR

OmniPage Pro 2.1	661
Readright 2.0	305
Wordscan Plus 1.1	667

### Network Interface Cards

3COM Etherlink II TP 16 bit (PCA)	\$175
3COM Etherlink II TP 16 bit 5 Pk	748
ADIC DCB Dsk Coprocessor Bd Ch1	322
Eagle NE1000 8bit Ethernet (PCA)	131
Eagle NE2000 16bit Ethernet (PCA)	162
Eagle NE3200A 32-bit Ethernet (EISA)	698
Eagle Netware Lite Add Kit NE2000	215
Eagle Netware Lite Str Kit NE2000	422
Proton ProNet-4/16 Busmstr (PCA)	516
SMC PC600WS Arcnet Serv 16bit CX	205
SMC PC600WS Arcnet Wkstn 16bit CX	127
Tan.Commod Ethnet 10base-T (PCA)	121
Tan.Commod Ethnet 10base-T 10 Pk	1,355

### Scanners & Input Devices

Logitech 2-Butt Ser Mouse w/Win	71
Logitech Trackman Serial	54
MS Ballpoint Mouse	125
MS Bus Mouse w/Pointbrush	105
MS Bus Mouse w/Win 3.1	156
MS Ser Mouse 5-Pack	383
Summa Summascanner II 12x12 16bit	345
Thumbnail Portable	63
Coreo Typist+ Graphics OCR Scannr	914
HP Scanjet IIP w/Interface (PCA)	391
Logitech Scanman Mod 256 (PCA)	273
Logitech Scanman Mod 32 (PCA)	137

### Languages & Programming Tools

ABC Flowchart 1.13	\$182
Asymetrix Toolbook 1.5	291
Barland C++ 3.1	338
DR DOS 6.0	67
Interactive Easyflow 7.0	193
MS Basic Comp 7.1 (DOS/OS/2)	328
MS C with C++ 4.5	327
MS Cobol Comp 4.5 (DOS/OS/2)	395
MS Device Driver 3.1.1/Windows	532
MS Pascal Comp 4.0 (DOS/OS/2)	139
MS Quick C 1.0 for Windows	192
MS Visual Basic 1.0/Windows	132
MS Windows SDK 3.0	330
MS-DOS 5.0 (generic)	48
MS-DOS 5.0 Upgrade	59
Objection 3.1	105
Turbo C++ 3.1 for Windows	105
Turbo Debugger & Tools 2.0	105
Turbo Pascal 1.5 for Windows	121
Zortech C++ 3.0 (DOS/WIN/OS/2)	465
Zortech C++ Sci & Eng 3.0 (D/W/O)	664

### Integrated Packages

Lotus Symphony 2.2	505
Lotus Works 3.0	92
Microsoft Works 2.0	99
Wingz for PC 1.1A	320
WordPerfect Works 1.0	94

### Network/Multiuser

Novell NetWare 2.2 10 User	1,170
Novell NetWare 2.2 50 User	2,343
Novell NetWare 3.11 10 User	1,481
Novell NetWare 3.11 100 User	4,152
Novell NetWare 3.11 20 User	2,049
Novell NetWare Lite	70
PC-MOS 4.1 - 5 User	459

### Productivity Tools

Dan Backlinks Demo II 3.0	201
Microsoft Money 1.0	46
Microsoft Office 2.5	496
Microsoft Productivity Pak 3.1	265
On Target 1.0	465
Packrat 4.0 for Windows	243

### Communications

Carbon Copy 1.0 for Windows	\$133
Close-up Customer/Terminal 3.0	123
Crosstalk 3.0 for Windows	120
Dynacomm Term Emul Asynchronous	141
Microcenter 1.0	67
Procomm Plus 1.0 for Windows	82
Procomm Plus 2.01	70
Relay Gold 5.0	175
Smartterm 240 3.1	207
Winconnect 1.0A	61
Winfax Pro	74

### Utilities

386 Max Pro 6.01	61
Back-It 4.1.0	53
Central Point Antivirus 1.3	84
Central Point Backup 7.1	84
Check-It 3.0	83
Fastback Plus 3.0	122
HDC Icon Designer 2.0	333
Laplink Pro 4.0	104
Microsoft Windows Debugger 3.1	130
Norton Antivirus 2.0 (DOS/Win)	85
Norton Backup 2.0 (DOS/Win)	86
Norton Desktop 1.0 for DOS	118
Norton Desktop 2.0 for Windows	99
PCTOOLS 7.1 (DOS/Windows)	112
QDOS III Gazette 1.0	43
QEMM 386 Exp Mem Mgr 6.01	61
Stacker 2.0	86
Super PC-Kwik 4.1	47
Superstar 2.0	78
Xtree Gold 2.5	97

### Workgroup/Group Productivity

CC-Mail 1.0 Windows Platform Pk	343
CC-Mail 3.2 - 8 User Pack	135
CC-Mail 3.2 MS-DOS Platform Pack	136
MS PC Mail 2.1 - 20 User Lic Pk	889
MS PC Mail 2.1 Remote Wkstn	129
MS PC Mail 2.1 Server	459
WordPerfect Office PC 3.01	89

Please call for items not listed

## SOFTLINE MAKES BUYING AS SIMPLE AS ...

1.

### Ordering



Fax your order & inquire to us 24 hours a day

1-718-438-2315



Call us at

1-718-438-6057

(9:00 to 17:00 U.S. EST, Mon.-Fri.)

All prices and payments are in U.S.D., and do not include shipping, insurance, and other fees. VAT and duties will be collected at delivery. Please confirm prices, availability, shipping costs and other fees at time of order. Please specify 3 1/2" or 5 1/4" diskette size.

2.

### Shipping



Ask for  
Federal Express,  
DHL or UPS,

if you want 2 to 4 day service through customs to your door.



For large orders, we also ship via economic Air Freight, with 1 week delivery. Please confirm shipping costs when placing your order.

3.

### Payment



For fastest Ordering, use your Visa, MasterCard, American Express, or EuroCard. Simply provide us with your credit card number, expiration date, shipping and billing addresses when ordering. A 3% surcharge is added.

Or you can...

Wire Transfer funds directly to our account at Manufacturer's Hanover Trust (ABAF 021000306) 4901-13th Ave., Brooklyn, NY 11219 Account No. 1042063596065. Please add \$15.00 wire transfer fee and applicable shipping charges. Allow 1 week for confirmation of transfer.

We accept bank checks in US Dollars payable on a US Bank. Send your order with payment.

TERMS: All prices are subject to change without notice. We do not charge your credit card until your order is shipped. All returns require prior authorization and RA number from our customer service department. (Minimum 20% restocking fee on returns). All returns are to be shipped prepaid and insured.



Softline International Division

1333 60th Street, Brooklyn, NY 11219 FAX: 1-718-438-2315



# DON'T GO TOO FAR!

**Computers**

**Floppydrives**

**LAN products**

**Keyboards**

**U.P.S.**

**Printers**

**Notebooks**

**Digitizers**

**Monitors**

**Harddisks**

**Peripherals**

**Plotters**

**Cases**

**Mainboards**

**ECG**

**EUROPEAN COMPUTER GROUP**

**YOUR EUROPEAN PARTNER**

## Your business is safe with us!

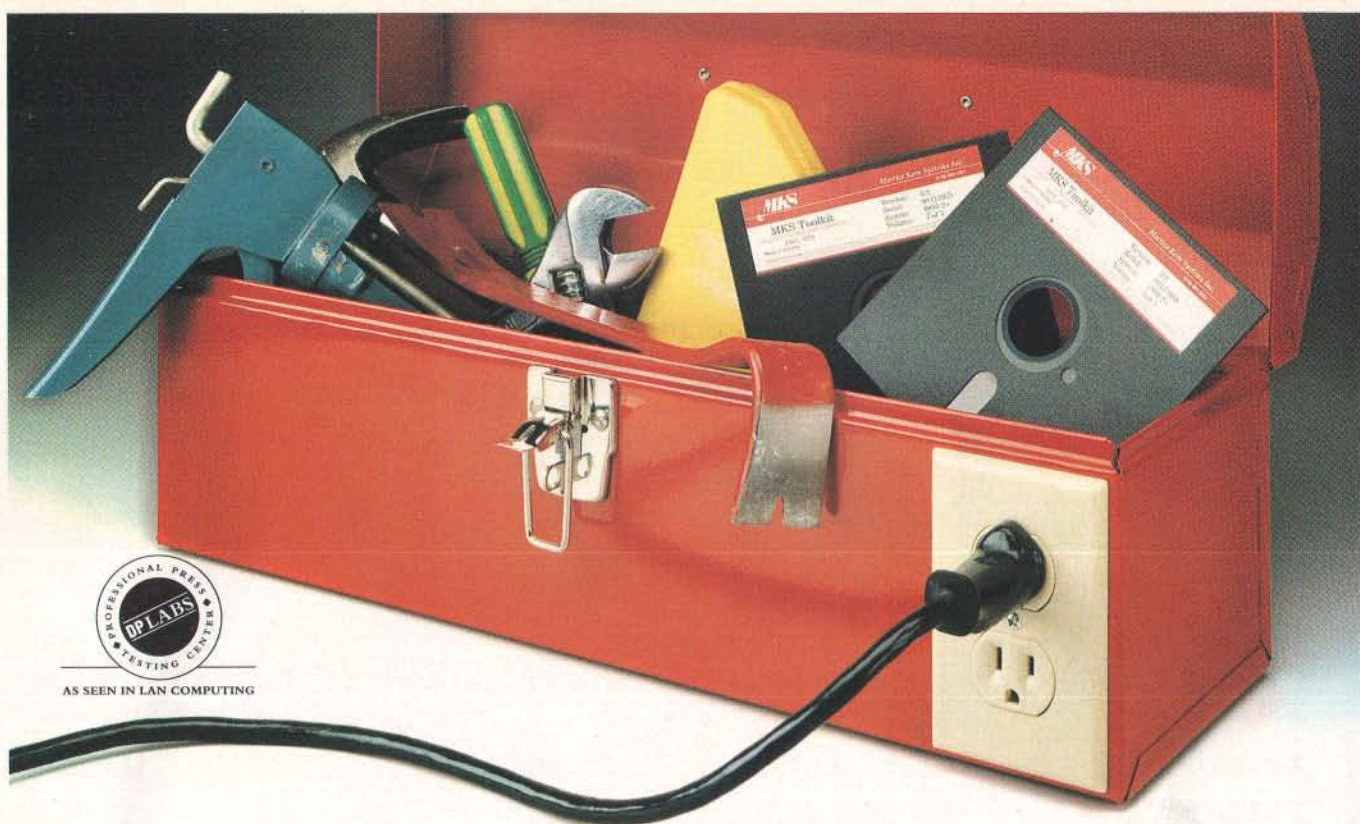


European Headquarters:  
European Computer Group B.V.  
P.O. Box 116  
5710 AC Someren  
Netherlands  
Tel.: 31-4937-90005  
Fax: 31-4937-96808

Circle 412 on Inquiry Card.

**DEALERS OEMS  
DISTRIBUTORS WANTED**





AS SEEN IN LAN COMPUTING

# Put more power in your PC

Plug MKS Toolkit into any DOS or OS/2 PC and you'll unleash more power and flexibility than you ever believed your hardware could handle. You'll find that MKS Toolkit is **the** essential piece of DOS or OS/2 software after the operating system itself.

**Advanced programming tools** once available only on UNIX™ systems are packed into MKS Toolkit for DOS or OS/2 – more than 150 of them, including utilities for:

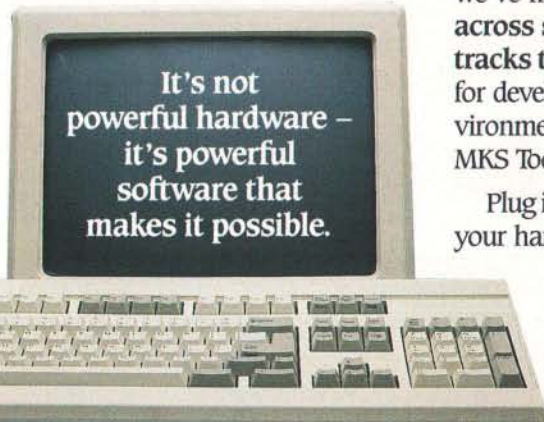
- prototyping
- advanced command language
- command editing and history

- file processing • text manipulation
- compression • archiving • editing.

And MKS Toolkit is **easy to use**, with on-line manual pages, lots of examples and quality documentation for both novices and experienced users.

You'll be able to get the job done effortlessly too, wherever you're working. For laptop owners, our installation procedure lets you **load only the utilities you want**. For developers working on a UNIX system and a PC, we've made it **easy to copy files across systems**. And MKS Toolkit **tracks the POSIX.2 standard**, a plus for developers in open systems environments. **Networks** are perfect for MKS Toolkit too.

Plug in MKS Toolkit and soar beyond your hardware.



 **MKS Toolkit**

Australia 03 580 1333  
03 419 0300  
Benelux 020 6 14 24 63  
Brazil 083 322 1904  
Denmark 04288 7249  
England 0736 244114  
0386 53499  
071 833 1022

Finland 8 0 505 4536  
France 01 4877 2244  
01 4781 1011  
Germany 0551 507 620  
0721 988 280  
06 126 595 0  
030 852 00 45  
Italy 02 480 1111

Singapore 65 747 2266  
Sweden 0131 115 88  
0314 060 25  
Switzerland 061 47 32 01  
032 255 743

Full 30 day  
money back  
guarantee.

**MKS**

35 King Street North  
Waterloo, Ontario  
Canada. N2J 2W9

MKS and MKS Toolkit are trademarks of Mortice Kern Systems Inc.  
UNIX is a registered trademark of Unix System Laboratories, Inc.



Use these Postcards for Fast Response

## FROM CONCEPT TO ARTWORK IN 1 DAY

**ULTIBOARD**

Real Time Placement Tools: Force Vectors, Histograms,  
Direct Reconnect guarantee optimal comp. placement  
Unique Real Time DRC prevents shorts, clearance violations

Trace-Shoving pushes groups of traces aside  
Autorouting by net/component/window

Auto Polygon-fill-update

Output to photo/pen  
plotters (laser/printers)

Includes:

**ULTICAP**  
SCHEMATIC CAPTURE



Full Function  
Evaluation System  
incl. complete manuals  
and technical support

**\$ 150**

Incl. shipping & handling

Evaluation System offers all ULTicap and ULTiboard features

**ULTIBOARD = PRODUCTIVITY**

*The European quality alternative*



**ULTIMATE** MOTHERBOARD 486DX50 4Mb **\$1195**

The ideal hi-quality offer to upgrade your XT/AT/386 PC.

With Iccap for optimal reliability  
Latest AMI BIOS/ OPTI Chipset  
Dallas Battery (10 years lifetime!)  
256K Write Back cache, 4M RAM.

486DX33 version **\$ 795**  
486SX25 version **\$ 495**



See other side for  
detailed specs.

**3.50**  
PER DISK  
10 disks or more

**GREAT SOFTWARE**  
for IBM PC's and Compatibles

**4.00**  
PER DISK  
1 to 9 disks

### BUSINESS/HOME

- ☐ Best DOS Utilities (4 disks)(3520)—Collection of the best DOS utilities.
- ☐ Brother's Keeper 5.0 (4 disks)(3120)—Excellent genealogy program.
- ☐ DanCAD 3-D (5 disks)(2860)—Superb, full-featured CAD! (CGA) (HD)
- ☐ FormGen/FormFill (2 disks)(3240)—Create and/or fill out any form.
- ☐ Image Print 4.0 (2 disks)(3220)—Fancy fonts on dot matrix printers!
- ☐ MealMaster 6.31 (2 disks)(3160)—Recipe filer with 1200+ recipes (HD)
- ☐ Online Bible 5 (14 disks)(3170)—KJV Bible, Greek/Hebrew lexicon. (HD)
- ☐ PrintPartner (2 disks)(3260)—Make great banners, signs, calendars, etc!
- ☐ Resume Creators (2 disks)(3270)—A great help in finding a better job.
- ☐ Screen Savers for DOS (2 disks)(4790)—Collection of great blankers.
- ☐ Vaccines & Virus Killers (4 disks)(3510)—Protection from 900+ viruses.
- ☐ DOS Tutorials (3 disks)(1490)—All about DOS & more. Covers 2.0-5.0!
- ☐ Skyglobe/Earthwatch (2 disks)(1880)—See stars, planets & more. (CGA)
- ☐ Typing Teacher (2 disks)(1440)—Learn to type or improve your skills!

### GAMES

- ☐ Best Arcade Games (2 disks)(1660)—18 of the best games! (CGA)
- ☐ CGA Tetris Collection (2 disks)(1970)—7 superb variations (CGA)
- ☐ Chess Challengers/Tutor (2 disks)(4340)—2 games & a tutor! (CGA)
- ☐ Best EGA Games (4 disks)(1680)—15 of the best EGA games!
- ☐ Commander Keen Collection (3 disks)(2240)—Two of the best games of all time! Great graphics & sound. Truly superb games. (HD)(EGA)
- ☐ EGA Mouse Solitaire (3 disks)(1930)—Solitaire at its best! (Mouse)(EGA)
- ☐ EGA/VGA Tetris Collection (3 disks)(1920)—9 hi-res variations! (EGA)

### WORD PERFECT

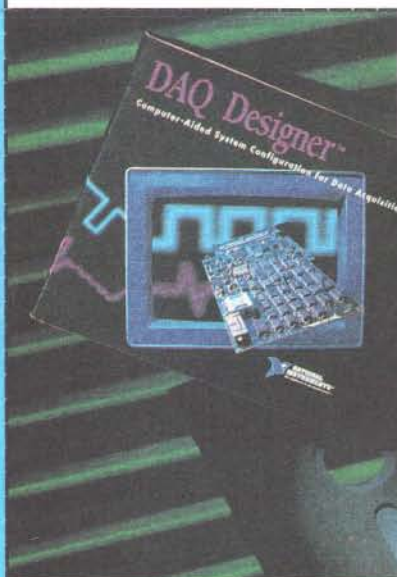
- ☐ WordPerfect 5.1 Learning System (4 disks)(4230)—Learn WP 5.1 easily.
- ☐ WordPerfect 5.1 Desktop Publishing Learning System (3 disks)(4270)—Learn how to use WordPerfect 5.1 as a desktop publisher.
- ☐ WordPerfect 5.1 Macros (2 disks)(4220)—100+ macros for WP 5.1
- ☐ WordPerfect 5.0/5.1 Tools (3 disks)(3750)—17+ utilities for WP 5.0/5.1
- ☐ By Design (4255)—Turns WordPerfect 5.1 into a desktop publisher
- ☐ PC-Draft II & III (3 disks)(3760)—Create & modify clip art for WP 5.0/5.1

### MICROSOFT WINDOWS PROGRAMS

- ☐ Best Games for Windows (4 disks)(4880)—30+ games for Windows!
- ☐ The Complete Icon Collection (4 disks)(4580)—4000+ of the best icons!
- ☐ Icon Utilities (4 disks)(4260)—Create, modify, view & manage icons.
- ☐ Grab Plus 6.2 for Windows (2 disks)(4570)—Address & print envelopes!
- ☐ HyperDisk 4.3 (4539)—Make Windows (& DOS) run 2-10 times faster!
- ☐ Screen Savers for Windows (4615)—7 great screen savers for Windows!
- ☐ Utilities for Windows (4 disks)(4510)—50+ essential utilities!
- ☐ Wallpaper for Windows Vol. 1 (4 disks)(4520)—75+ backgrounds.
- ☐ ATM Fonts Vol. 1 (4 disks)(4710)—30+ fonts for Adobe Type Manager.
- ☐ ATM Fonts Vol. 2 (4 disks)(4720)—30+ fonts for Adobe Type Manager.
- ☐ ATM Fonts Vol. 3 (4 disks)(4730)—30+ fonts for Adobe Type Manager.
- ☐ ATM Fonts Vol. 4 (4 disks)(4740)—30+ fonts for Adobe Type Manager.
- ☐ ATM Fonts Vol. 5 (4 disks)(4750)—30+ fonts for Adobe Type Manager.
- ☐ ATM Fonts Vol. 6 (4 disks)(4760)—30+ fonts for Adobe Type Manager.

Requires: (HD)—Hard disk (CGA)—CGA Graphics (EGA)—EGA Graphics

Call Toll Free 800-876-3475 or 503-776-5777 (Fax 503-773-7803) or send this card.



## Get Your Data Acquisition System Right...The First Time!

**D**AQ Designer, from National Instruments, is a free computer-aided configuration tool for the PC that takes you step-by-step through your application, asking you questions, and recommending the correct:

- PC plug-in data acquisition boards
- signal conditioning products
- cable assemblies
- software packages



Requires  
VGA  
Monitor

For your free DAQ Designer return this card  
or call: (512) 794-0100  
(800) 433-3488 (U.S. and Canada)

Free DAQ Designer™ Software



# ORDER CARD Please send us/me by FREE courier:

Please indicate your case preference:  
☐ Desktop ☐ Low profile (flat) ☐ Mini-Tower

Please indicate your language (keyboard/manuals):  
☐ Engl. ☐ Deutsch ☐ Franç. ☐ Nederl. ☐ Esp. ☐ Ital.

Personal Workstation OPTIONS (not available separately)

**ULTIMATE** G-2000 (i.o. ET-4000) \$ 250,-  
**ULTIMATE** 17" (i.o. 14") colour monitor \$ 750,-  
 125 Mb Colorado tape streamer \$ 250,-  
 8Mb (i.o. 4 Mb) DRAM + 210Mb Hard disk \$ 500,-



12 Months Warranty. Unlimited technical support from multinational European Company established in 1973. Local studies into ECU and for sales tax may apply. ULTiboard, ULTicaps and ULTimate are registered trademarks of ULTimate Technology BV/Ltd GmbH Corp. The Intel Inside logo is a trademark of Intel Corporation. All trademarks are of their respective companies.

**ULTIBOARD** PCB-Design & Schematic \$ 150,-  
 Capture Evaluation-System (All Features! ;  
 incl. manuals; capacity 350 Pins)

Please indicate your payment method:

☐ Bank transfer to 02.17.73.505 ING Bank, Bussum, the Netherlands  
☐ American Express ☐ Eurocard/MC ☐ VISA  
 No. \_\_\_\_\_  
 Exp. Date \_\_\_\_\_ Signature: \_\_\_\_\_

**ULTIMATE** Motherboard 486/25 4Mb RAM, 8K cache \$ 495  
 Motherboard 486/33 4Mb RAM, 256K cache \$ 795  
 Motherboard 486/50 4Mb RAM, 256K cache \$ 1195  
**ULTIMATE** Personal Workstation 486/50/DX \$ 2995  
 486/50 4Mb RAM 256K cache (See above); Western Digital  
 125 Mb cached Hard disk < 14 ms, 3.5" & 5.25" Floppy drives;  
 14" High Quality monitor 1024 x 768 non-interlaced;  
 ET-4000 Video (option: G2000-Windows S3-accelerator)  
 2 serial/1 parallel port; Logitech serial mouse;  
 MS/DOS 5.0 & WINDOWS 3.1 (original Microsoft manuals)  
**ULTIMATE** Personal Workstation 486/33/DX \$ 2595  
 Personal Workstation 486/25/SX \$ 2295  
**ULTIMATE** G-2000 Graphics Engine \$ 395  
 17" flatscreen colour monitor MF 8317 \$ 1495



Company Name (if appl.): \_\_\_\_\_

Your Name: \_\_\_\_\_

Street: \_\_\_\_\_ Code: \_\_\_\_\_

City: \_\_\_\_\_ Country: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

Please send/fax to: ULTimate Technology BV, Int. Reply Number 464,  
 1400 WC NAARDEN, The Netherlands • NO POSTAGE NECESSARY  
 Fax: (+31) 2159 - 43345 • Phone: (+31) 2159 - 44444

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City / State / Zip \_\_\_\_\_

Phone \_\_\_\_\_

Disk Size: ☐ 5 1/4" ☐ 3 1/2" (add 50¢ per disk)

No. disks \_\_\_\_\_ x \$ \_\_\_\_\_ = \$ \_\_\_\_\_

Shipping and handling \$ 4.00

Federal Express Next Day Air (add \$7) \$ \_\_\_\_\_

Federal Express 2nd Day Air (add \$5) \$ \_\_\_\_\_

COD (add \$5) \$ \_\_\_\_\_

Canada (add \$2) \$ \_\_\_\_\_

Foreign outside U.S./Canada (add \$4) \$ \_\_\_\_\_

TOTAL ORDER \$ \_\_\_\_\_

Method of Payment:

☐ Visa ☐ MasterCard ☐ Check/M.O. enclosed ☐ COD (add \$5)

Card No. \_\_\_\_\_

Exp. Date \_\_\_\_\_ Signature \_\_\_\_\_

To order send this card or call:

Toll free 800-876-3475 or 503-776-5777, Fax 503-773-7803.

We accept Visa, MasterCard, Check or Money Order.

Shareware programs require separate payment to the authors if found useful.

BYTI 10/92

PLACE  
POSTAGE  
HERE



**Reasonable Solutions**

2101 West Main Street  
 Medford, Oregon 97501  
 USA

LOWEST PRICES  
 SAME-DAY SHIPPING • LATEST VERSIONS  
 ALL PROGRAMS COME WITH INSTRUCTIONS ON DISK  
 UNCONDITIONAL MONEY-BACK GUARANTEE

BYTI 10/92

Name \_\_\_\_\_  
 Title \_\_\_\_\_  
 Company \_\_\_\_\_  
 Mail Stop \_\_\_\_\_  
 Address \_\_\_\_\_  
 City/Country/Code \_\_\_\_\_  
 Phone ( ) \_\_\_\_\_ Ext. \_\_\_\_\_

Place  
Postage  
Here



**NATIONAL  
INSTRUMENTS®**  
 The Software is the Instrument®

TNT Mailfast  
 FRG/BOS/700251/MO1  
 P.O. Box 66  
 Hounslow  
 TW5 9RT  
 England

Use these Postcards for Fast Response



# YOUR DIRECT LINK CARD

For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

Yes, I want FREE information on the following products!

Fill out this coupon carefully. Please Print.

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Country \_\_\_\_\_ Code \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

A. What is your primary job function/principal area of responsibility? (Check one)

- ☐ 1 MIS/DIP  
☐ 2 Programmer/Systems Analyst  
☐ 3 Administration/Management  
☐ 4 Sales/Marketing  
☐ 5 Engineer/Scientist  
☐ 6 Other

B. What is your level of management responsibility?

- ☐ 7 Senior-level ☐ 9 Professional  
☐ 8 Middle-level

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?

- ☐ 10 Yes ☐ 11 No

D. What operating systems are you currently using? (Check all that apply)

- ☐ 12 PCMS-DOS ☐ 15 Unix  
☐ 13 DOS + Windows ☐ 16 MacOS  
☐ 14 OS/2 ☐ 17 VAX/VMS

E. For how many people do you influence the purchase of hardware or software?

- ☐ 18 1-25 ☐ 20 51-99  
☐ 19 26-50 ☐ 21 100 or more

October 1992

90 96 98

Product Category Information	Disks & Optical Drives	7	Multimedia	19	Educational	30	Shareware	42
	Diskettes/Duplicators	8	Printers/Plotters	20	Engineering/Scientific	31	Software Duplication	43
	Fax Boards/Machines	9	Programmable Hardware	21	Entertainment	32	Spreadsheets	44
	Graphics Tablets/Mice/		Scanners/OCR/Digitizers	22	Graphics	33	Unix	45
	Pen Input	10	Tape Drives	23	Macintosh	34	Utilities	46
	Keyboards	11	UPS	24	Mail Order	35	Windows	47
	LAN Hardware	12	Software		Mathematical/Statistical	36	Word Processing	48
	Laptops & Notebooks	13	Business	25	Miscellaneous Software	37	General	
	Mail Order	14	CAD/CAM	26	On-Line Services	38	Books/Publications	49
	Memory/Chips/Upgrades	15	Communications/Networking	27	Operating Systems	39	Recruitment	50
	Miscellaneous Hardware	16	Data Acquisition	28	Programming Languages/		Miscellaneous	51
	Modems/Multiplexors	17	Database	29	Tools	40		
	Monitors & Terminals	18			Security	41		

## Inquiry Numbers 52-233

52	78	104	130	156	182	208
53	79	105	131	157	183	209
54	80	106	132	158	184	210
55	81	107	133	159	185	211
56	82	108	134	160	186	212
57	83	109	135	161	187	213
58	84	110	136	162	188	214
59	85	111	137	163	189	215
60	86	112	138	164	190	216
61	87	113	139	165	191	217
62	88	114	140	166	192	218
63	89	115	141	167	193	219
64	90	116	142	168	194	220
65	91	117	143	169	195	221
66	92	118	144	170	196	222
67	93	119	145	171	197	223
68	94	120	146	172	198	224
69	95	121	147	173	199	225
70	96	122	148	174	200	226
71	97	123	149	175	201	227
72	98	124	150	176	202	228
73	99	125	151	177	203	229
74	100	126	152	178	204	230
75	101	127	153	179	205	231
76	102	128	154	180	206	232
77	103	129	155	181	207	233

## Inquiry Numbers 409-590

409	435	461	487	513	539	565
410	436	462	488	514	540	566
411	437	463	489	515	541	567
412	438	464	490	516	542	568
413	439	465	491	517	543	569
414	440	466	492	518	544	570
415	441	467	493	519	545	571
416	442	468	494	520	546	572
417	443	469	495	521	547	573
418	444	470	496	522	548	574
419	445	471	497	523	549	575
420	446	472	498	524	550	576
421	447	473	499	525	551	577
422	448	474	500	526	552	578
423	449	475	501	527	553	579
424	450	476	502	528	554	580
425	451	477	503	529	555	581
426	452	478	504	530	556	582
427	453	479	505	531	557	583
428	454	480	506	532	558	584
429	455	481	507	533	559	585
430	456	482	508	534	560	586
431	457	483	509	535	561	587
432	458	484	510	536	562	588
433	459	485	511	537	563	589
434	460	486	512	538	564	590

## Inquiry Numbers 766-947

766	792	818	844	870	896	922
767	793	819	845	871	897	923
768	794	820	846	872	898	924
769	795	821	847	873	899	925
770	796	822	848	874	900	926
771	797	823	849	875	901	927
772	798	824	850	876	902	928
773	799	825	851	877	903	929
774	800	826	852	878	904	930
775	801	827	853	879	905	931
776	802	828	854	880	906	932
777	803	829	855	881	907	933
778	804	830	856	882	908	934
779	805	831	857	883	909	935
780	806	832	858	884	910	936
781	807	833	859	885	911	937
782	808	834	860	886	912	938
783	809	835	861	887	913	939
784	810	836	862	888	914	940
785	811	837	863	889	915	941
786	812	838	864	890	916	942
787	813	839	865	891	917	943
788	814	840	866	892	918	944
789	815	841	867	893	919	945
790	816	842	868	894	920	946
791	817	843	869	895	921	947

## Inquiry Numbers 1123-1304

1123	1149	1175	1201	1227	1253	1279
1124	1150	1176	1202	1228	1254	1280
1125	1151	1177	1203	1229	1255	1281
1126	1152	1178	1204	1230	1256	1282
1127	1153	1179	1205	1231	1257	1283
1128	1154	1180	1206	1232	1258	1284
1129	1155	1181	1207	1233	1259	1285
1130	1156	1182	1208	1234	1260	1286
1131	1157	1183	1209	1235	1261	1287
1132	1158	1184	1210	1236	1262	1288
1133	1159	1185	1211	1237	1263	1289
1134	1160	1186	1212	1238	1264	1290
1135	1161	1187	1213	1239	1265	1291
1136	1162	1188	1214	1240	1266	1292
1137	1163	1189	1215	1241	1267	1293
1138	1164	1190	1216	1242	1268	1294
1139	1165	1191	1217	1243	1269	1295
1140	1166	1192	1218	1244	1270	1296
1141	1167	1193	1219	1245	1271	1297
1142	1168	1194	1220	1246	1272	1298
1143	1169	1195	1221	1247	1273	1299
1144	1170	1196	1222	1248	1274	1300
1145	1171	1197	1223	1249	1275	1301
1146	1172	1198	1224	1250	1276	1302
1147	1173	1199	1225	1251	1277	1303
1148	1174	1200	1226	1252	1278	1304

## Inquiry Numbers 234-408

234	259	284	309	334	359	384
235	260	285	310	335	360	385
236	261	286	311	336	361	386
237	262	287	312	337	362	387
238	263	288	313	338	363	388
239	264	289	314	339	364	389
240	265	290	315	340	365	390
241	266	291	316	341	366	391
242	267	292	317	342	367	392
243	268	293	318	343	368	393
244	269	294	319	344	369	394
245	270	295	320	345	370	395
246	271	296	321	346	371	396
247	272	297	322	347	372	397
248	273	298	323	348	373	398
249	274	299	324	349	374	399
250	275	300	325	350	375	400
251	276	301	326	351	376	401
252	277	302	327	352	377	402
253	278	303	328	353	378	403
254	279	304	329	354	379	404
255	280	305	330	355	380	405
256	281	306	331	356	381	406
257	282	307	332	357	382	407
258	283	308	333	358	383	408

## Inquiry Numbers 591-755

591	616	641	666	691	716	741
592	617	642	667	692	717	742
593	618	643	668	693	718	743
594	619	644	669	694	719	744
595	620	645	670	695	720	745
596	621	646	671	696	721	746
597	622	647	672	697	722	747
598	623	648	673	698	723	748
599	624	649	674	699	724	749
600	625	650	675	700	725	750
601	626	651	676	701	726	751
602	627	652	677	702	727	752
603	628	653	678	703	728	753
604	629	654	679	704	729	754
605	630	655	680	705	730	755
606	631	656	681	706	731	756
607	632	657	682	707	732	757
608	633	658	683	708	733	758
609	634	659	684	709	734	759
610	635	660	685	710	735	760
611	636	661	686	711	736	761
612	637	662	687	712	737	762
613	638	663	688	713	738	763
614	639	664	689	714	739	764
615	640	665	690	715	740	765

## Inquiry Numbers 948-1122

948	973	998	1023	1048	1073	1098
949	974	999	1024	1049	1074	1099
950	975	1000	1025	1050	1075	1100
951	976	1001	1026	1051	1076	1101
952	977	1002	1027	1052	1077	1102
953	978	1003	1028	1053	1078	1103
954	979	1004	1029	1054	1079	1104
955	980	1005	1030	1055	1080	1105
956	981	1006	1031	1056	1081	1106
957	982	1007	1032	1057	1082	1107
958	983	1008	1033	1058	1083	1108
959	984	1009	1034	1059	1084	1109
960	985	1010	1035	1060	1085	1110
961	986	1011	1036	1061	1086	1111
962	987	1012	1037	1062	1087	1112
963	988	1013	1038	1063	1088	1113
964	989	1014	1039	1064	1089	1114
965	990	1015	1040	1065	1090	1115
966	991	1016	1041	1066	1091	1116
967	992	1017	1042	1067	1092	1117
968	993	1018	1043	1068	1093	1118
969	994	1019	1044	1069	1094	1119
970	995	1020	1045	1070	1095	1120
971	996	1021	1046	1071	1096	1121
972	997	1022	1047	1072	1097	1122



# YOUR DIRECT LINK CARD

**For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!**

See reverse side for card.

## 1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

## 2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

**3. Product information will be rushed to you from the selected companies!**

**BYTE**  
TNT MAILFAST  
FRG/BOS/700252/MO1  
P.O. Box 66  
Hounslow  
TW5 9RT  
England

PLACE  
POSTAGE  
HERE



**BYTE** 



# Silicon Brains

Innovative computer devices are being inspired by the results of research  
on the brains of nature's creatures

T. J. SEJNOWSKI AND P. S. CHURCHLAND

**I**magine a computing device that would revolutionize the stoop-labor sector of agriculture or perform many of the necessary but tedious tasks in other industries. Such agribots would need computational insides that are small, inexpensive, and enormously powerful.

Existing digital computers lack the efficiency, autonomy, flexibility, and adaptability required by the fictional agribots. However, the brains of birds, fish, mammals, and even insects prove that powerful, fast, flexible, and self-reliant computers can solve these problems (see the text box "Bee Smart" on page 142). Breakthroughs in neuroscience, combined with new computational devices such as analog VLSI chips, have made it possible to begin to reverse-engineer nature.

In addition to the sheer intellectual value of understanding ourselves, understanding how brains work could produce important economic benefits. If you know evolution's computational tricks and architectural ingenuities regarding speed, power, and flexibility, you can apply them to a variety of areas: image processing, speech recognition, free-form handwriting recognition, and holographic applications.

Current-generation neural networks capture some of the brain's general features (e.g., the parallel architecture). But neural networks represent only the beginning of brain-style computer technology.

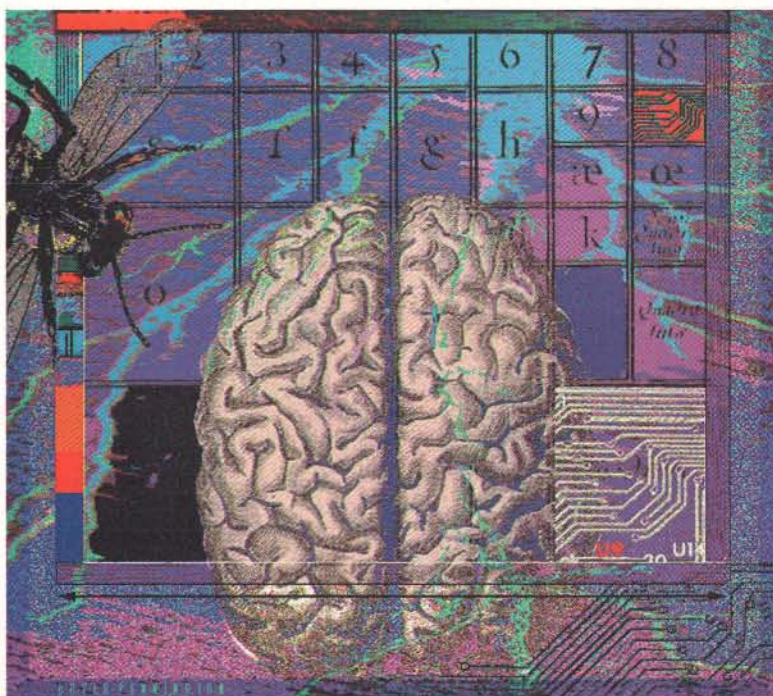
## Computing in Parallel

While digital technology is still very much in its heyday, there is tremendous potential in analog VLSI for addressing real-world problems. For example, current algorithms running on a digital machine can correctly read written numerals on credit-card sales forms about 60 percent of the time. The problem of machine-reading postal ZIP codes on letters is compounded by the problem of locating the digit, which is unsolved.

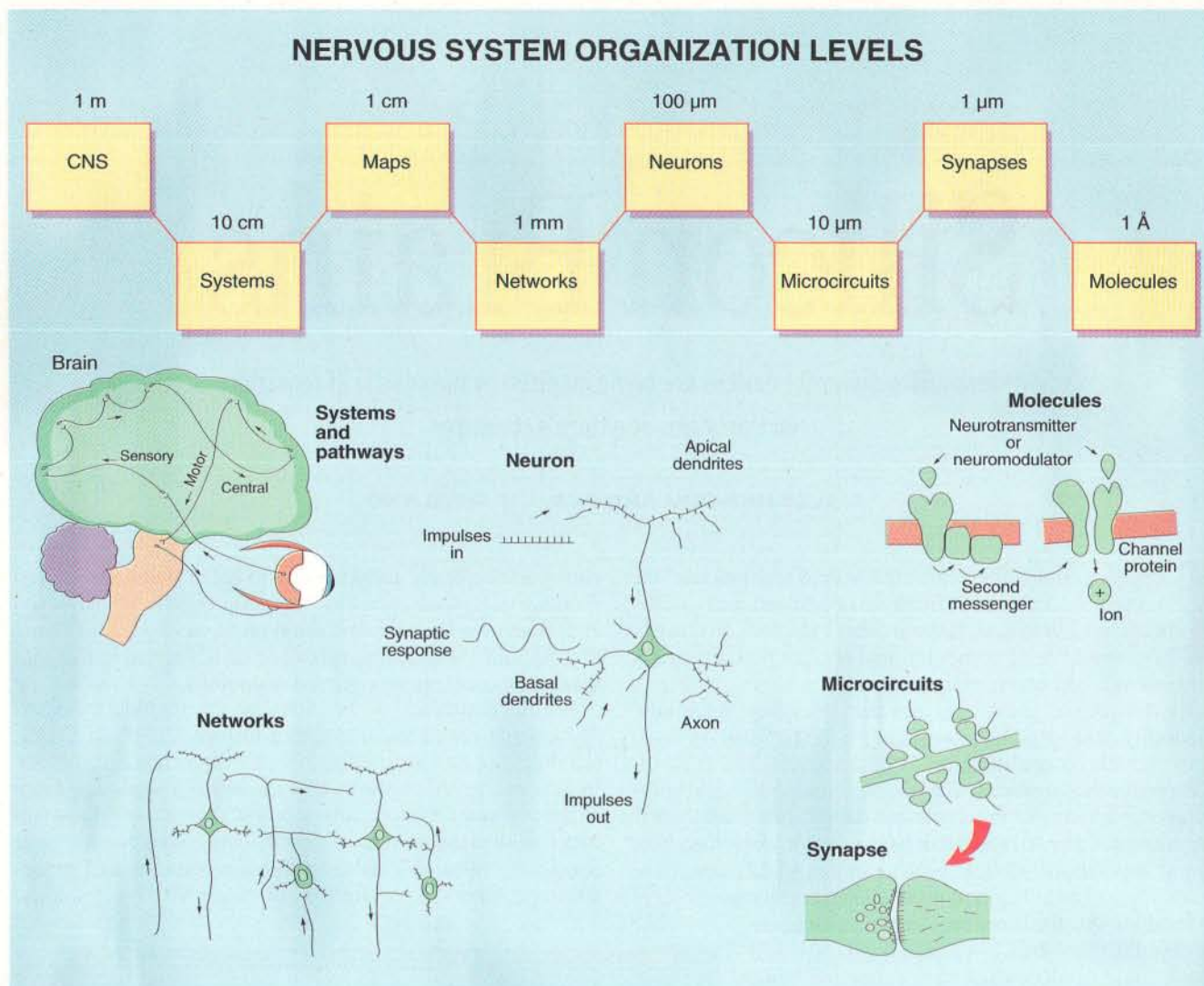
The crux of the difficulty is that digital ma-

chines are typically programmed to solve the segmentation problem (e.g., what character does a squiggle belong to?) and after that, to solve the recognition problem (e.g., is it a 0 or a 6?). Should the machine misolve or fail to solve the segmentation problem, recognition is doomed.

Brains, it appears, do not serialize the segmentation and recognition problems in lockstep fashion. As often as not, recognitional cues are used to solve the segmentation problem. In general, people believe that the brain's approach more closely resembles cooperative computation or constraint satisfaction than theorem proving. Of course, it takes a lot more computing to be able to solve the segmentation and recognition problems in parallel. With analog VLSI technology,







The components of nervous systems include the brain and spinal cord, systems (e.g., the visual system), maps (e.g., the retina or the skin), networks (perhaps of many thousands of interconnected neurons), the individual neuron, microcircuits, synapses, and ion channels.

people are learning how to build machines that really compute in parallel.

### Reverse Engineering the Brain

*Computational neuroscience* is the study of how the brain represents the world and how it computes. Being able to model the brain's neural circuits by computer is essential in finding out how neurons (i.e., the cellular components of nervous systems) interact with each other to produce complex effects (see the figure). Such effects include segregating a figure from its background, recognizing a banana from different angles, and following items moving in 3-D space.

Neuroscience contributes three main ingredients to this effort: anatomical parameters (e.g., the precise tree structure of various neuron types and the exact mode of

connectivity between neurons in a particular real network), physiological parameters (e.g., the response characteristics of neurons, time constants, and synaptic strengths), and clues to the function of the human biological neural network and its computational mode of operation in executing that function.

Many techniques that neuroscientists use to study the brain involve intervention—lesioning or electrical stimulation. Analyzing a working model can provide neurobiologists with information about unsuspected mechanisms and interaction; they can then test the results under actual conditions.

This type of collaboration between computer modeling and neuroscience is already producing ideas for new and innovative computing procedures. It has resulted in architectural designs for interacting in real time, storing associative memory more efficiently, coordinating

### Applications Benefiting from Brain Research

- Image processing
- Optical character recognition
- Speech recognition
- Handwriting recognition
- Holography



# STATISTICA/w

DOS, Windows,  
Macintosh

**STATISTICA/w™** (for Windows) Complete Statistical System with thousands of on-screen customizable, presentation-quality graphs fully integrated with all procedures ■ Complete Windows 3.1 support, DDE, OLE, TT-fonts, multiple toolbars, right mouse button support ■ Unlimited numbers of data-, results-, and graph-windows ■ Inter-window integration: data, results, and graphs can be treated as objects and converted into one another in a number of ways ■ The largest selection of statistics and graphs in a single system; comprehensive implementations of: Exploratory techniques; multi-way tables with banners (presentation-quality reports); nonparametrics; distribution fitting; multiple regression; general nonlinear estimation; stepwise logit/probit; general ANCOVA/MANCOVA; stepwise discriminant analysis; log-linear analysis; factor analysis; cluster analysis; multidimensional scaling; canonical correlation; item analysis/reliability; survival analysis; time series modeling; forecasting; lags analysis; quality control; process analysis; experimental design (with Taguchi); and much more ■ Manuals with comprehensive introductions to each procedure and examples ■ Hypertext-based Stats Advisor expert system ■ Extensive data management facilities (spreadsheet with long formulas, block operations, advanced Clipboard support, DDE hot links, relational merge, data verification, powerful programming language) ■ Batch command language and macros also supported, "turn-key system" options ■ All output displayed in Scrollsheets™ (dynamic, customizable, presentation-quality tables with toolbars, pop-up windows, and instant D, 3D and multiple graphs) ■ Extremely large analysis designs (e.g., correlation matrices up to 32,000x32,000, unlimited ANOVA designs) ■ Megafile Manager with up to 32,000 variables (8 Mb) per record ■ Unlimited size of files; extended ("quadruple") precision; unmatched speed ■ Exchanges data and graphs with other applications via DDE or an extensive selection of file import/export facilities ■ Hundreds of types of graphs, including categorized multiple 2D and 3D graphs, matrix plots, icons, and unique multivariate (e.g., 4D) graphs ■ Facilities to custom design new graphs and add them permanently to menu ■ On-screen graph customization with advanced drawing tools, interactive stretching and resizing of complex objects, interactive embedding of graphs and artwork, special effects, icons, maps, multi-graphics management, page layout control for slides and printouts; unmatched speed of graph redraw ■ Interactive rotation, perspective and cross-sections of all 3D and 4D graphs ■ Extensive selection of tools for graphical exploration of data: fitting, smoothing, overlaying, spectral planes, projections, layered compressions, marked subsets ■ Price \$995.

**Quick STATISTICA/w™** (for Windows) A comprehensive selection of basic statistics and the full graphics capabilities of STATISTICA/w ■ Price \$495.

**STATISTICA/dos™** (for DOS) A STATISTICA/w-compatible data analysis system ■ Price \$795.

**Quick STATISTICA/dos™** (for DOS) A subset of STATISTICA/dos statistics and graphics ■ Price \$295.

Domestic sh/h \$10 per product; 14-day money back guarantee.

Circle 170 for DOS. Circle 171 for MAC.

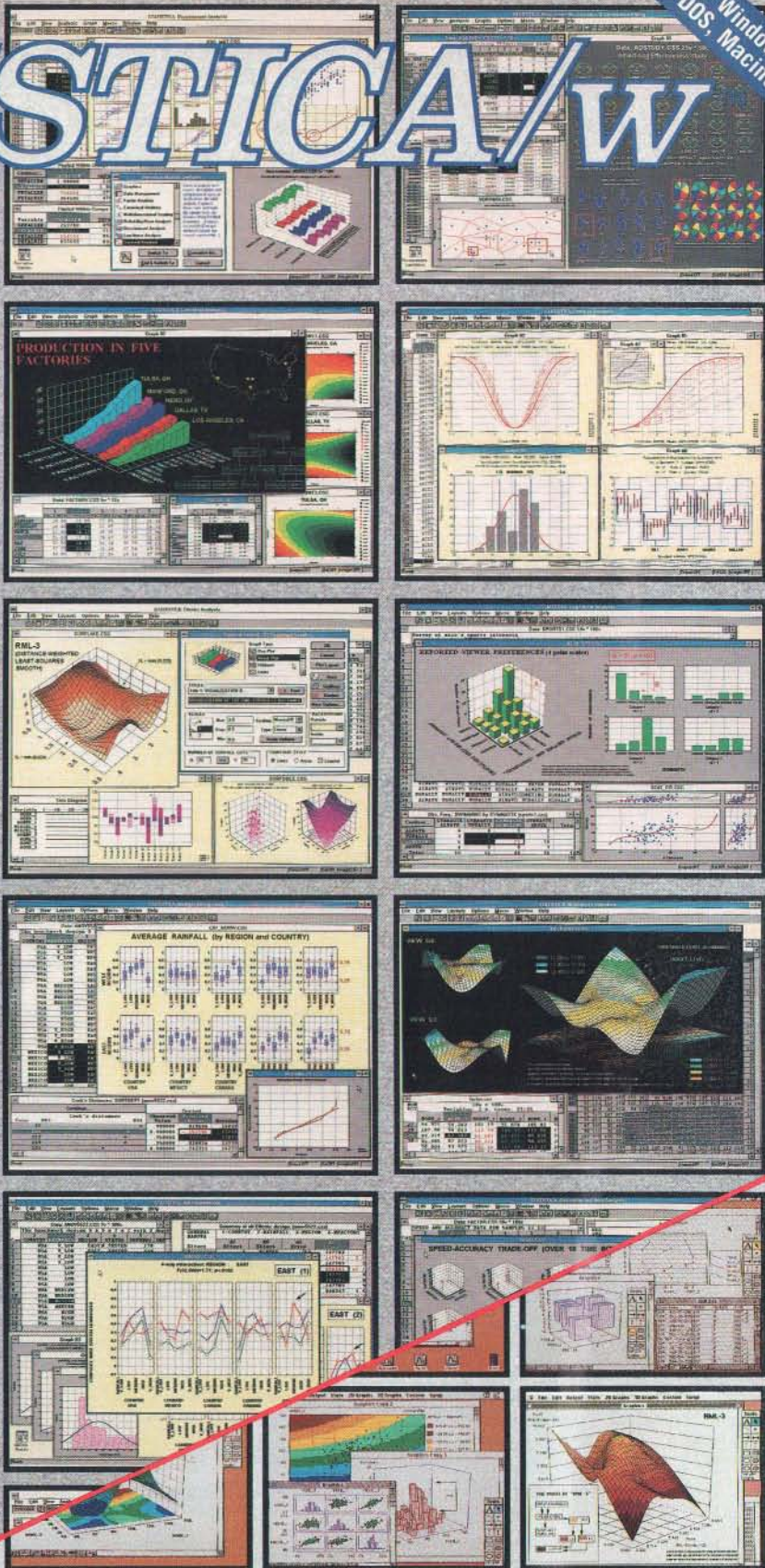


**StatSoft™**

2325 E. 13th St. • Tulsa, OK 74104 • (918) 583-4149  
Fax: (918) 583-4376

Overseas Offices: Statsoft of Europe (Hamburg, FRG), ph: 040/4200347, fax: 040/4911310; StatSoft UK (London, UK), ph: 0462/482822, fax: 0462/482855; StatSoft Pacific (Melbourne, Australia), ph: (03) 663 5580, fax: (03) 663 6117; StatSoft Canada-CCO (Ontario), ph: 416-849-0737, fax: 416-849-0918. Available From: CORPORATE SOFTWARE and other Authorized Representatives Worldwide: Holand: MAB Julsing, 071-230410; France: Version US (1) 40590913; Sweden: AkademiData 018-240035; Hungary: Dagent Kft 186-5782; Belgium: TEXMA 10 61 16 28; South Africa: Osins 12 663-4500; Japan (Macintosh): Three's Company, Inc., 03-3770-7600; Japan (DOS and Windows): Design Technologies, Inc., 03-3667-1110.

StatSoft, STATISTICA/w, Quick STATISTICA/w, STATISTICA/Mac, Quick STATISTICA/Mac, STATISTICA/DOS, Quick STATISTICA/DOS, and Scrollsheet are trademarks of StatSoft, Inc.



**STATISTICA/Mac™** (for Macintosh) A STATISTICA/w-compatible, comprehensive data analysis and graphics system designed for the Macintosh ■ Large selection of statistical methods fully integrated with presentation-quality graphics (incl. EDA, multiplots, a wide selection of interactively rotatable 3D graphs; MacDraw-style tools) ■ Unlimited size of files ■ Full support for System 7, incl. "Publish and Subscribe" ■ Price \$595.

**Quick STATISTICA/Mac™** (for Macintosh) A subset of STATISTICA/Mac: a comprehensive selection of basic statistics and the full graphics capabilities of STATISTICA/Mac ■ Price \$295.





# Glossary

**axon** Part of a neuron that conducts impulses away from the cell body.

**Brownian motion** The random movement of particles caused by the collision of the molecules in the fluid around those particles.

**cortical structure** Structures found in the cortex, a region of the brain.

**cytoplasm** The fluid outside the nucleus but within the membrane of a cell.

**dendrite** Part of a neuron that conducts electrical signals toward the cell body.

**ion channel** Proteins in the cell membrane that may reconfigure to let specific ions (e.g.,  $\text{Ca}^{2+}$ ) enter the cell in response to chemical or electrical signals.

**lesion** An abnormal change in an organ's structure due to injury, disease, or an experimental procedure.

**maps** Regions of the brain where the topography of neurons corresponds to the topography of the sensory surface (e.g., the retina or the skin).

**mitochondria** Structures found in the cytoplasm that produce energy through cellular respiration.

**neurons** The functional units of the brain (i.e., the cellular components of the nervous system). An individual neuron can be either excited or inhibited by inputs from other neurons.

**photon** A packet, or *quanta*, of electromagnetic energy (e.g., light).

**photoreceptor** A receptor for visible light stimuli.

**pyramidal neuron** A type of neuron found in cortical structures.

**synapse** The point of contact between adjacent neurons where nerve impulses are transmitted from one neuron to the other.

mixed modality, multiplexing, and understanding attention selectivity.

## Simulate or Synthesize?

Digital machines are not yet powerful enough to faithfully simulate the nervous system's processes and do it in real time. One or the other is sacrificed. The problem is that the simulation strategy consists of compartmentalizing the phenomena and solving vast numbers of differential equations; thus, compared to the real thing, it is pitifully slow.

In a neuron, ions pass back and forth across a membrane, signals are integrated, and output spikes are produced—all in a matter of a few milliseconds. However, to simulate just 1 ms in a neuron's life, computers must solve thousands of coupled nonlinear differential equations.

To compound the problem, these equations use a wide variety of time scales. In the simulation, the time steps can be only as long as the shortest significant interval. Consequently, even a powerful workstation will take minutes to simulate 1 ms of real time of the electrical and chemical events occurring in a single neuron. You can circumvent this problem by constructing dedicated hardware for synthetic neurons and nervous systems. One strategy is to construct neuron-like chips.

To construct chips that compute as well as neurons do, you must first understand how neurons perform. The production of a spike in a neuron's axon is an all-or-nothing affair. Even axonal spiking is analog in some respects (e.g., when spikes occur, how frequently spikes happen, and how long it takes to repolarize them). The main analog integration of

synaptic inputs occurs in dendrites.

Real circuits have many imperfections. Invariably, they do not meet the ideal, the components are not homogeneous, membranes leak, components malfunction or drop dead, and cross-coupling occurs. But you can't shun chip construction entirely in favor of performing simulations. The best long-term direction people should take seems to be to find out how real circuits obtain precision, speed, and power from imperfect and imprecise components. Somehow, neurons operate in real time and cope magnificently, probably by exploiting imperfections to their advantage. The coping capacity of real-world neurons is itself computationally interesting.

Neurons are organic. They use fatty molecules to make resistive membranes. Complex proteins make ion channels that let current flow across the membrane, and cytoplasm acts as the medium for transmitting current. Mitochondria are the neuron's miniature powerpacks; circulating oxygen is their energy source. But what can you use to construct synthetic neurons?

## Synthetic Neurons

Analog VLSI technology turns out to be well suited to constructing synthetic neurons for two reasons. One is theoretical, and the other is practical.

The device physics of doped silicon operating in subthreshold regions is comparable to the biophysics of ion channels in the neuron membrane. Therefore, you can implement the differential equations directly with analog circuits in CMOS VLSI. And the same techniques used to create digital VLSI chips can be adapted to make analog VLSI chips. Carver Mead of Caltech and Synaptics and Federico Faggin of Synaptics, industry pioneers

**You can't shun chip construction entirely in favor of performing simulations.**



# Real Stats. Real Easy.

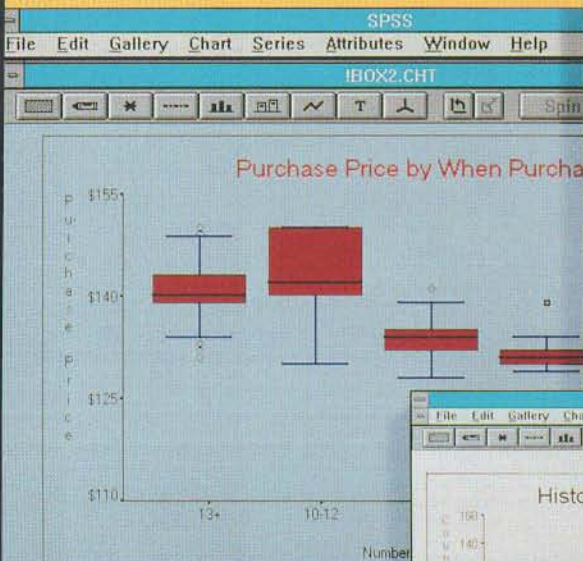
Answer Your Really Tough Questions with SPSS for Windows.

## Complete Data Management and Editing

"The data management capabilities are excellent – even better than dBASE." – William O'Hara, Ph.D., Patrick Associates. Enter data or read it directly from Excel™, Lotus® dBASE® and SQL™ databases, then edit it and use it many ways – easily.

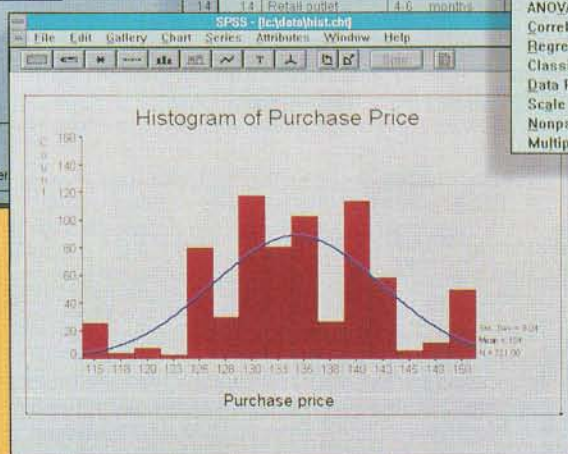
## Learn Fast, Work Fast

"It's extremely easy to learn and use. With just the little bit of Windows experience I have, I got through without touching the manual." – John J. Kalamarides, Greenwich Associates. The 100% Windows interface makes doing analysis simple. Hypertext help and an on-line glossary of statistical terms are just a click away.



## Automatic Statistical Graphics

"The graphics are superb. Integrating the charting capabilities directly into the statistical procedures was a brilliant move." – Zvia Segal Naphtali, Resource Mobilization Inc. Create statistical charts like histograms, boxplots and scatterplots automatically; there's no relabeling or respecifying.



## In-depth Statistics

"I haven't run into a statistical calculation I needed that I couldn't find." – Thomas W. Gruen, CBA Service Corp. Use correlations, crosstabs, regression and more. You won't grow out of this package.

What factors influence purchases? Is service quality high? Are dosage levels optimal? You need answers you can be confident in. But, you can't do in-depth analysis with your spreadsheet or database – they only give you simple sums and percentages.

Don't stay locked in a spreadsheet cell. Break out with SPSS® for Windows™. Subset, sample, aggregate, explore, summarize, poke, prod, slice and dice your data to get the answers you need. Analyze surveys, dig into databases, improve quality, conduct research studies, forecast sales and prepare reports with ease. All without writing complex macros or queries. Find relationships, see patterns and trends, determine significance and use the past to predict the future.

Learn fast, work fast. Prepare for your analysis quickly with SPSS' full-featured Data Editor. Choose from a broad range of statistical routines that produce full-color charts automatically. Hot button between charts and related numerical output. Share information using DDE and OLE. Put together a great presentation with our business graphics, reports and tables. If you need help, the documentation is full of statistical "how to," and experienced technical support is just a phone call away.

For a limited time, you can get answers to your really tough questions at a really special price.

Call 1(800) 543-5835 now for details.



# SPSS

Circle 169 on Inquiry Card.

Chicago • Washington, DC • Chertsey, UK • Gorinchem, The Netherlands • Munich • New Delhi • Singapore • Stockholm • Sydney • Tokyo • And Distributors Worldwide.



# Bee Smart

**S**tart by contrasting what a small honeybee can do with tasks that today's most powerful computers can't do, and add the fact that a honeybee's brain has only about 1 million neurons versus the human brain's 100 billion neurons. Then consider the following information:

**Energy efficiency.** A honeybee's brain dissipates less than 10 microwatts ( $10^{-6}$ ). It is superior by about seven orders of magnitude to the most efficient of today's manufactured computers.

**Speed.** A honeybee's brain, roughly and conservatively, performs at about 10 TFLOPS (10,000 GFLOPS). The most powerful of today's computers approach speeds of only 10 GFLOPS (i.e., 1 billion operations per second).

**Behavioral abilities.** Honeybees harvest nectar from flowers and bring it back to the hive. They maximize foraging benefits and minimize foraging costs—for example, by recognizing high nectar sites and remembering which flowers they have already visited.

Honeybees can see, smell, fly, walk, and maintain balance. They can navi-



**Photo A:** Anatomy of a fly's visual system. Like that of other insects, a fly's visual system is highly organized. The structure of the fly's system shows how the neurons (black) are organized into layers of visual processing. (Drawing by N. J. Strausfeld, *Atlas of an Insect Brain*, New York: Springer-Verlag, 1976)

gate long distances and predict changes in nectar location. They communicate the location of nectar sources to worker bees in the hive; they recognize intruders and attack; they remove garbage and dead bees from the hive; and, when the hive becomes crowded, a subpopulation will swarm in search of a new home.

**Autonomy and self-reliance.** Honeybees manage these activities entirely on their own without any help from superior beings. By contrast, a supercomputer needs the constant tender care of a cadre of maintainers and programmers.

**Size.** A honeybee's brain takes up only about a few cubic millimeters of space. It is a marvel of miniaturization. You cannot reach all the way around a supercomputer.

From this comparison, it seems we have a way to go in allowing computers to perform some of the simpler things in life. Nature and its creatures are models for ways in which to improve our computing devices. (See photo A for an inside view of the insect visual system.)

who played leading roles in digital chip technology, are now spearheading the development of analog chip technology for neural systems.

With analog VLSI, a chip can follow the brain's lead—for example, concurrently solving segmentation and recognition problems. As reported this year in *Nature*, Misha Mahwold and Rodney Douglas, both of Oxford and Caltech, achieved the first step in building silicon neurons (see the text box "Silicon Neurons" on page 144).

Using analog VLSI, Mahwold and Douglas created a chip that mimics selected properties of pyramidal neurons, a type of neuron found in cortical structures. Their silicon neuron consists of only one compartment (the cell body) and four types of ion channels in the membrane. By contrast, a real pyramidal neuron might have thousands of dendritic segments, as well as an axon, tens of thousands of synapses, and scores of various ion channels.

As a pilot project, however, the Mahwold/Douglas silicon neuron was successful on several counts. First, it ran in real time. This meant that Mahwold and Douglas could conduct experiments by tweaking parameters in real time, such as the density of a given type of channel. Second, the neuron's output

behavior for varying amounts of current (displayed on an oscilloscope) closely resembled that of a real pyramidal cell under various physiological conditions. Third, the neuron consumes little power.

The successful debut of a single synthetic neuron has made possible several other potential developments: By adding more compartments (corresponding to dendrites) and a wider range of ion channels, you could improve the synthetic neuron's computational capabilities. Another possible development is that of building many neurons on a single chip. You could then explore synthetic neural circuits to learn more about the computational possibilities inherent in various parameters.

Ideally, you should be able to tweak thousands of parameters in real time; thus, interfaces need to be flexible and user friendly. Using synthetic circuits would mean that you could explore neurons in virtual reality rather than having to watch points appear on a graph on your screen.

A further refinement would be to make the chip able to learn from experience. Then, instead of having to hand-set neuronal connections, you could use a training regime. Mead and his group are currently developing trainable chips that can modify connectivity based on learning certain rules similar to those



# COMPUTING KNOW HOW

## Learn with computer books from Abacus



### DR DOS 6.0 Complete

The user's guide to running DR's new DR DOS 6.0 operating system. From introduction, to the basics, to using and understanding DRDOS 6.0, you'll learn to optimize your DRDOS system to your needs. 800 pages.

Item #B144. ISBN 1-55755-144-8. Suggested retail price \$34.95 with 3 1/2" companion diskette.

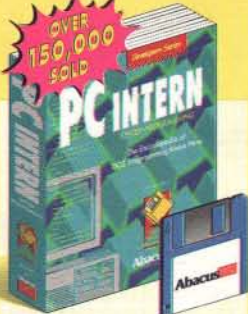


### DOS 5.0 Complete Special Edition

Learn the 'ins and outs' of DOS 5.0.

- Using the new SHELL, DOSKEY, EDIT, and QBasic
- Complete comprehensive DOS command reference section
- Includes Tempest software-the graphic shell for DOS 5.0. 900 pages.

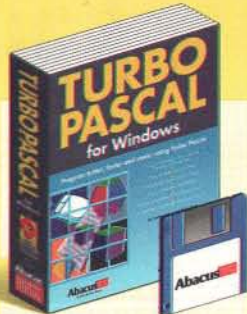
Item #B151. ISBN 1-55755-151-0. \$39.95 with Tempest and utilities diskette.



### PC Intern

The encyclopedia of DOS programming know how for the professional programmer. Includes parallel working examples in ML, C, Pascal and BASIC. DOS and BIOS internal structures and functions. Programming video cards, sound and TSRs. 1300 pages.

Item #B145. ISBN 1-55755-145-6. \$59.95 with over 2mb of source code on one diskette.



### Turbo Pascal for Windows

Introduction to the standard elements of Turbo Pascal.

- Development of the WinCrt, WinCrt and WinDOS units
- Comprehensive coverage of the Object Oriented Programming (OOP) features. 950 pages.

Item #B141. ISBN 1-55755-141-3. Suggested retail price \$39.95 with 3 1/2" companion diskette.



### Turbo C++ Step by Step

Teaches you C++, the language of choice among professional developers at your own pace.

The lessons are designed to be short, progressive and to the point, so you can learn quickly.

Item #B156. ISBN 1-55755-156-1. Suggested retail price \$34.95 with 3 1/2" companion diskette.

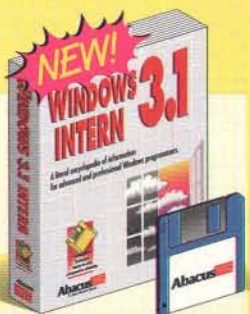


### Windows 3.1 Complete

Learn to optimize & customize Windows 3.1.

- Improve your productivity with the built-in Windows applications
- Includes dozens of useful tips and techniques
- Includes two valuable Windows utilities: Backup & Snapshot 875+ pages.

Item #B153. ISBN 1-55755-153-7. Suggested retail price \$34.95 with Windows utilities diskette.



### Windows 3.1 Intern

Introduces the reader to the overall concept of Windows programming and events using dozens of easy-to-follow examples. It's a solid guide for beginning to intermediate Windows programmers who need to know more, faster. 1200+ pages.

Item #B159. ISBN 1-55755-159-6. Suggested retail price \$39.95 with 3 1/2" companion diskette.



### The 486 Book

Explains the features that make this processor so advantageous - the memory capabilities, the math coprocessor, the specialized software that maximizes the CPU's performance and more. PC Info program on companion diskette.

Item #B155. ISBN 1-55755-155-3. Suggested retail price \$34.95 with 3 1/2" companion diskette.



### OS/2 COMPLETE

From installation, to overview, to the basics of the Presentation Manager, you'll learn how to take full advantage of this new operating environment.

Item #B157. ISBN 1-55755-157-X. Suggested retail price \$24.95.

### Stepping Up To OS/2 V2

The upgrader's guide to learning OS/2 in a hurry.

Item #B160. ISBN 1-55755-160-X. Suggested retail \$16.95.



### Sound Blaster Book

This book gives you a guide to the Sound Blaster from installation to custom programming. Includes an overview of the different Sound Blaster boards, many specific software products and much more.

Also includes simple MIDI system to use with your Sound Blaster.

Item #B164. ISBN 1-55755-164-2. Suggested retail price \$34.95 with 3 1/2" companion diskette.

Available at B. Dalton Booksellers, CompUSA, Crown Books, Software etc, Waldensoftware, Computer City, and other retailers nationwide. In the UK call Computer Bookshops 021-706-1188. In Australia call Pacronics 02-748-4700.

## Abacus

Dept. B10, 5370 52nd Street SE, Grand Rapids, MI 49512  
Phone: (616) 698-0330 • Fax: (616) 698-0325

**Order Toll Free**  
**1-800-451-4319**

In US and Canada add \$5.00 postage.  
Foreign orders add \$13.00 postage per item. We accept Visa, Mastercard or American Express.

**Circle 61 on Inquiry Card**  
**(RESSELLERS: 621)**

Please rush me the following books:

DR DOS 6.0 Complete .....	\$34.95 ea.
DOS 5.0 Complete S.E. ....	\$39.95 ea.
PC Intern .....	\$59.95 ea.
Turbo Pascal for Windows ..	\$39.95 ea.
Turbo C++ Step by Step .....	\$34.95 ea.
Windows 3.1 Complete .....	\$34.95 ea.
Windows 3.1 Intern .....	\$39.95 ea.
The 486 Book .....	\$34.95 ea.
OS/2 COMPLETE .....	\$24.95 ea.
Stepping Up to OS/2 .....	\$16.95 ea.
The SoundBlaster Book .....	\$34.95 ea.

Subtotal:

CA & MI orders include correct sales tax:

In US & Canada add \$5.00 shipping:

Foreign orders add \$13.00 per item:

Total amount (US funds):

**For fast delivery Order Toll Free 1-800-451-4319 EXT. 210, or FAX (616) 698-0325**

**Or mail this coupon to: Abacus, 5370 52nd Street SE, Grand Rapids, MI 49512**

**Method of Payment:** ☐ Visa ☐ Master Card ☐ Am. Express ☐ Check / M.O.

Card#: \_\_\_\_\_ Expires: \_\_\_\_/\_\_\_\_/\_\_\_\_

Name: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Phone#: \_\_\_\_\_ Fax#: \_\_\_\_\_

☐ **Yes, please rush your free catalog of PC books and software.**

Dept. B10



# Silicon Neurons

RODNEY DOUGLAS AND MISHA MAHWOLD

Neurons in the living body have electrical and chemical mechanisms that let them act together to represent and respond to behaviorally significant physical events. Over time, neurons have learned to manipulate how their membrane conducts various ions to produce electrical events that form a basis for computation.

Neuronal systems compute in fundamentally different ways than electronic computers do. Neurons are massively interconnected. The neurons shown in the reconstructed neocortical pyramidal cell (see photo A) receive input to their dendrites (green) from thousands of input cells and transmit to thousands of output cells via the synapses (white) made by their axons (red).

Neurons operate in the millisecond range rather than in the nanosecond range. The human brain generates  $10^{16}$  operations per second (compared to the supercomputer's  $10^9$  operations per second). But the power consumption of the brain is only  $10^{-15}$  joules per operation (compared to an electronic processor's roughly  $10^{-7}$  joules per operation).

The perception of an object is an unsolved computational problem. The vast majority of neural computations as complex as perception are less than 100 operations deep. This fact reflects the essentially distributed nature of neural computation, in which algorithms express themselves as connectivity and processors are indistinguishable from memory. Certainly, it seems that people can learn about computing from the field of biology.

Neuroscientists are learning about



**Photo A:** A reconstructed neocortical pyramidal cell from a cat. The cell's neurons receive input to their dendrites (green) from thousands of input cells and transmit to thousands of output cells via the synapses (white) made by its axons (red). (Photo courtesy of Rodney Douglas and Kevan Martin at MRC Cambridge)

neural computation through reverse engineering. They combine experimental neuroscience with neuromorphic systems made from analog CMOS VLSI technology. Fortunately, the physical properties of analog CMOS are similar to those governing the electrical behavior of neurons and neural systems; therefore, analog CMOS is a

convenient medium for building neuromorphic systems, just as the properties of Lego make it appropriate for constructing structures and machines.

For example, we fabricated a generic silicon neuron that emulates the fluxes of the ionic currents that occur in real neurons. Consequently, the silicon neuron has the same computational properties (at the neuronal level) that real cells do. The neuron can emulate the behavior (i.e., personality) of any particular neuron in the nervous system simply by setting several parameters.

One exciting feature of the silicon neuron is that it behaves in real time regardless of its complexity or the number of neurons in the network. We are currently working to build many neurons, initially about 100 to 200 neurons, on a single chip.

In the not-too-distant future, we anticipate building networks of thousands of silicon neurons on multiple chips, with personalities and connectivity that can be modified in real time. Using these silicon neural networks, we will be able to emulate intelligent circuits in the brain (e.g., those of the visual system) and provide a test bed to investigate realistic learning mechanisms.

*Rodney Douglas and Misha Mahwold are members of the Medical Research Council Anatomical Neuropharmacology Unit at Oxford and the Computation and Neural Systems Program at Caltech. You can reach them on BIX c/o "editors" or on the Internet at [rjd@vax.oxford.ac.uk](mailto:rjd@vax.oxford.ac.uk) and [mam@vax.oxford.ac.uk](mailto:mam@vax.oxford.ac.uk), respectively.*

believed to underlie plasticity in nervous systems. Here, *plasticity* refers to a property of a neuron's body that undergoes a permanent change in shape, size, or composition under certain conditions.

Ultimately, you will want to create chips with subpopulations of neurons specialized for different tasks, in the manner that distinct brain regions—including visual cortex, auditory cortex, motor cortex, and so forth—are specialized. Learning from the ways that nature engineers specialization and integration functions

should provide valuable information.

Following nature's lead may require that people model patterns of neuronal connectivity, both long-range (on the order of centimeters) and short-range (millimeters). Nervous systems are remarkably fault-tolerant: A circuit and its ability to function can survive the death of individual neurons within the circuit. Artificial systems might be able to achieve comparable fault tolerance if they are made to imitate the brain's connectivity, modifiability, and processing style.

*continued*



# Take the Lead with DataFlex!



Isn't it time you experienced the benefits of object-oriented programming?

You can with DataFlex.

DataFlex's comprehensive 4GL, robust class libraries, object-oriented program generators, and proven database management system provide you with a complete library of tools for application development.

Generating complete object-oriented programs is as easy as clicking on AUTOCREATE in DataFlex's menu system. Utilizing DataFlex's many other language features lets you create fully customized CUA applications.

Experience faster development, easier maintenance, re-usable code, and better looking applications now with DataFlex for \$795.

The benefits of object-oriented programming are here now. Don't get left behind.

Take the lead... with DataFlex!

## Features of DataFlex:

- Object-Oriented Programming
- Application Generators
- Relational DBMS
- Portability (DOS, DOS Networks, Unix, Windows)
- Client/Server Solutions

## Time Saving Benefits of DataFlex:

- Reusable Code
- Easier Design
- Speed
- Flexibility
- Reliability

Call 1-800-451-FLEX for complete DataFlex information and the dealer nearest you.

**DATA ACCESS**  
CORPORATION

14000 SW 119 Avenue  
Miami, Florida 33186  
305/238-0012

For information via CompuServe: GO DAC

**Circle 93 on Inquiry Card  
(RESELLERS: 94).**

**Australia** 61-3-699-7044

**Austria** 43-662-658-2237

**Belgium/Luxembourg** 49-61-727-5014

**Brazil** 55-11-872-9266

**Canada** 416-226-2181/416-785-5041

**Chile** 56-2-231-7015

**Denmark** 45-45-76-4545

**France** 33-1-47-241-961

**Germany** 49-61-727-5014

**Hong Kong** 852-311-7922

**Italy** 39-587-422-022/39-51-437-025

**Japan** 81-480-856-565

**Mexico** 525-545-6327

**Minsk** 7-0172-236797

**Moscow** 7-095-4342060

**Netherlands** 31-74-555-609

**New Zealand** 64-9-772-701

**Norway** 47-2-559-966

**Singapore** 65-775-5588

**Spain** 34-1-402-2298

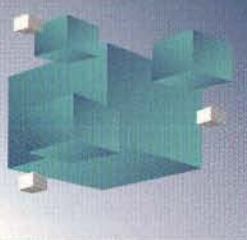
**Sweden** 46-300-19530

**Tallinn** 7-0142-238035

**United Arab Em.** 97-12-331-885

**United Kingdom** 44-71-729-4460

Prices may vary by country. DataFlex is a registered trademark of Data Access Corporation.



**DATA FLEX**

Object-Oriented 4GL  
Application Development Environment  
DBMS

**See us at Comdex/Fall, booth 2376**



## ANALOG VLSI VS. DIGITAL VLSI

Analog VLSI is strikingly superior to digital technology in terms of cost, power, and computation density. (Estimates by Federico Faggin.)

	Cost (MCS*\$/)		Power (MCS/watt)		Computation density (MCS/ft. <sup>3</sup> )	
	1991	2000	1991	2000	1991	2000
Conventional digital	0.002	0.1	0.1	10	0.2	10
Special-purpose digital	0.1	4	10	10,000	10	1000
Dedicated digital	5	200	500	50,000	40	3000
Dedicated analog	500	20,000	50,000	5,000,000	4000	4,000,000
Human brain	10 <sup>9**</sup>		10 <sup>10</sup>		10 <sup>11</sup>	

\* MCS = A million connection updates per second.

\*\* This calculation assumes that the cost of a human brain is \$10,000,000.

### Neural Circuits in Silicon

Peripheral sensory organs (e.g., the eye) are highly specialized parts of the body that translate external physical signals into electrical activity. The retina is a powerful preprocessor that transforms information about photons into a form suitable for neural representation and computation.

**The retina is a powerful preprocessor that transforms information about photons into a form suitable for neural representation and computation.**

In a number of animals, sensory transducers and preprocessors are about as sensitive as they can get. For example, in primates, photoreceptors in the retina will respond to just a few photons; the human ear can pick up sound close to that of Brownian motion. Powerful analog preprocessors shape the information into a neural-friendly form—but can they be reverse-engineered?

Mead has built a family of silicon retinas. Each silicon retina is a VLSI chip that is a square centimeter in area, weighs about a gram, and consumes about a milliwatt of power. Between arrays of phototransistors etched in silicon, dedicated circuits execute smoothing, contrast enhancement, and motion processing. The chip operates in its subthreshold, analog mode.

Compared with a typical CCD (charge-coupled device) camera and standard digital image processor, the Mead chip is a paragon of efficiency in performance, power consumption, and compactness. A special-purpose digital equivalent would be about the size of a standard washing machine. Unlike cameras that must time sample, typically at 60 frames per second, the analog retina works continuously without needing to sample until the in-

formation leaves the chip already preprocessed.

Operations performed with Mead's chip capture some of the functions that real retinas perform; however, real retinas contain many more circuits than Mead's synthetic one. While it makes sense to build chips to maximize efficiency in the three critical elements (i.e., power, cost, and density), you must still push analog VLSI techniques a long way to approximate neural efficiency. The incentive to go forward with this technology will depend on whether the payoff looks promising in the long term (see the table).

### Neuro-Revolutions

We are on the brink of two neuro-revolutions: one in the science of the brain and the other in the technology of brain-style computing. Knowledge grows exponentially: The more you have, the more you get—and the faster you get it. So it is in neuroscience. Almost every day, surprising discoveries about the organization and mechanisms of nervous systems are being reported.

The VLSI revolution has provided computer science with unprecedented tools to transform what we know about the brain into silicon. Silicon retinas are in production, silicon cochlea are nearing production, and oculobots (i.e., robotic eyes) are on the drawing board. Although it is nearly impossible to predict future technological breakthroughs, ever-more sophisticated neuro-engineering is in the offing. ■

### BIBLIOGRAPHY

- Churchland, P. S., and T. J. Sejnowski. *The Computational Brain*. Cambridge, MA: MIT Press, 1992.
- Dowling, John. *Neurons and Networks: An Introduction to Neuroscience*. Cambridge, MA: Harvard University Press, 1992.
- Levitin, Irwin B., and Leonard K. Kaczmarek. *The Neuron: Cell and Molecular Biology*. New York: Oxford University Press, 1991.
- Mead, Carver. *Analog VLSI and Neural Systems*. Reading, MA: Addison-Wesley, 1989.

*T. J. Sejnowski is an investigator with the Howard Hughes Medical Institute, director of the Computational Neurobiology Laboratory at the Salk Institute (La Jolla, CA), and a member of the biology department at the University of California—San Diego. P. S. Churchland is a member of the philosophy department at the University of California—San Diego and is an adjunct member of the Salk Institute. You can reach them on BIX c/o "editors" or on the Internet at tsejnowski@ucsd.edu and pschurchland@ucsd.edu, respectively.*



Optiquest 2000D

15" Monitor

# TAKING THE LEAD

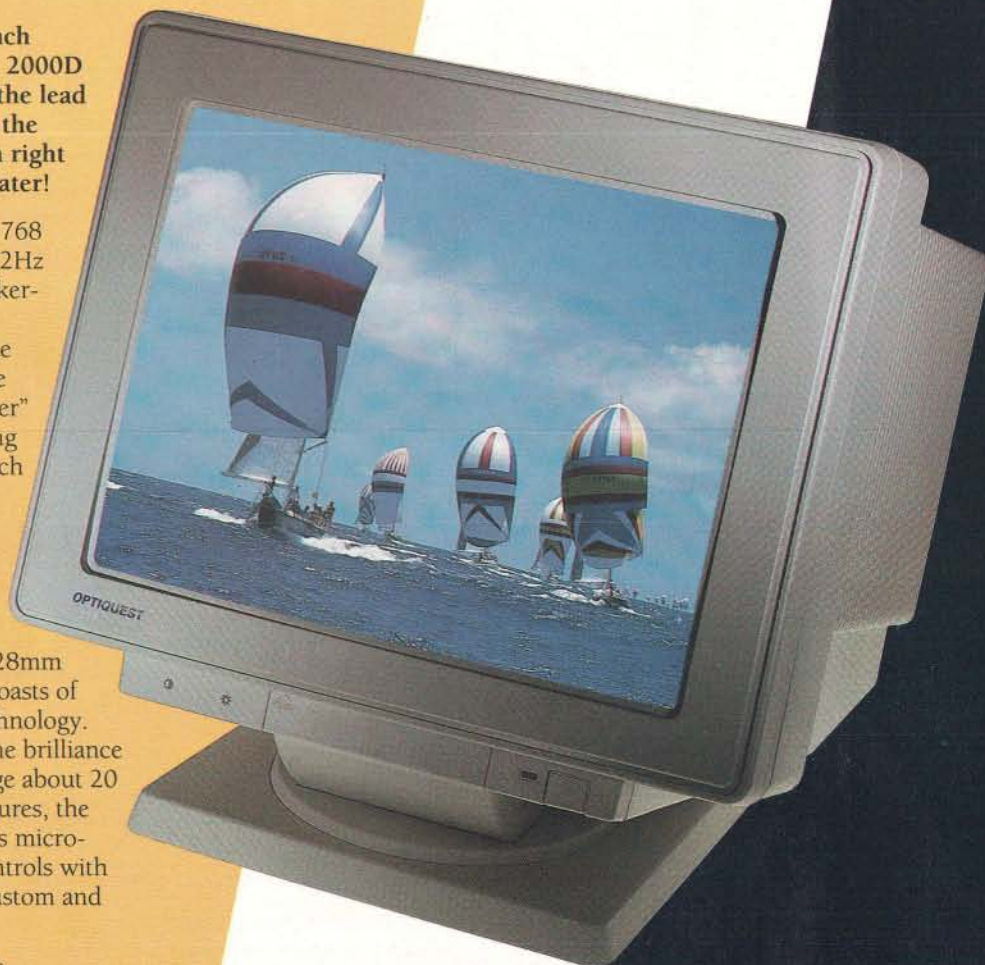
The 15-inch Optiquest 2000D has taken the lead and blown the competition right out of the water!

With 1,024 x 768 resolution at 72Hz refresh this flicker-free monitor, according to Byte Magazine, is "The performance leader" The award-winning 2000D has a 15-inch flat square screen with an edge-to-edge display. This results in 36-percent more viewing area.

Along with the fine 0.28mm dot pitch, the 2000D boasts of Invar Shadow Mask technology. Now you can increase the brilliance and crispness of the image about 20 percent. Packed with features, the Optiquest 2000D even has micro-processor-based digital controls with built-in memory for 124 custom and preset adjustments.

When you think of high performance monitors, think of Optiquest. We offer a full line of 14, 15 and 17-inch non-interlaced monitors at competitive prices.

**We're taking the lead.** Go to an authorized Optiquest reseller TODAY and you'll see what we mean.



#### OPTIQUEST, INC.

9830 Alburtis Ave.,  
Santa Fe Springs, CA 90670  
Tel: (310) 948-1185 (800) 843-6784  
Fax: (310) 949-2231

The Optiquest 2000D meets Swedish  
MPR-II standards for ELF and VLF low  
radiation emissions.

All products and brand names are brand names of their respective companies.

**Circle 136 on Inquiry Card (RESELLERS: 137).**

**"... Optiquest 2000D  
is the overall  
performance leader."**

Byte Magazine: May 1992

## OPTIQUEST

The Non-interlaced Company



# Attention All dBASE Users: Your Windows Have Arrived.

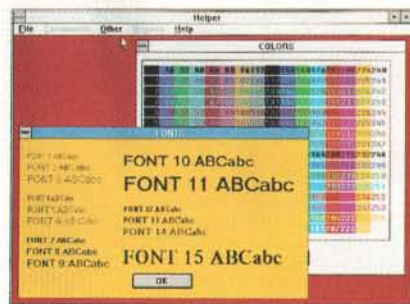


Introducing new dBFast™. The first and only dBASE™ compatible database and

dBASE/X-Base language for Windows. It's the fastest, smartest and easiest way for millions of users and developers to join the Windows revolution.



Graphical, colorful dBFast will bring new life to all of your

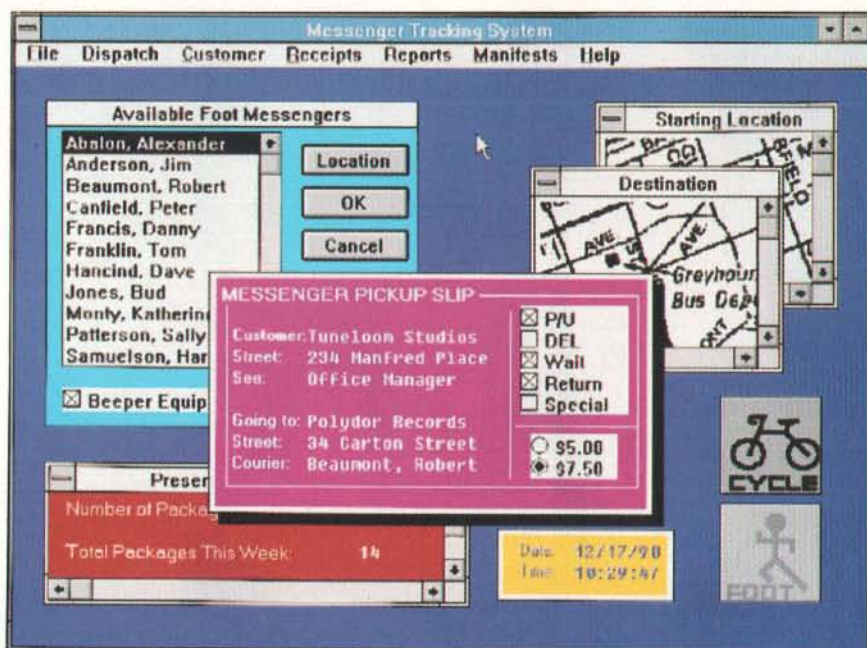


*Your applications will really come to life with multiple colors and fonts.*

existing dBASE programs.

Liven them up with multiple, movable windows, pull-down menus, check boxes, dialog boxes, radio buttons, push buttons and bitmap pictures.

dBFast also helps



*dBFast helps you create powerful, graphical database applications quickly and easily with pull-down menus, check boxes, radio buttons and even bitmap images.*

you create new dBASE programs quickly and easily.

Unlike other Windows development systems that force you to learn a new language, dBFast allows dBASE, Fox and Clipper developers to use the language they already know with more than 200 extensions and an interactive editor, compiler and linker.

And full industry standard DDE and DLL protocols allow

your programs to communicate with other Windows applications.

So call 1-800-CALL CAI and we'll rush you a free Demo Disk.

Call right now. After all, haven't you waited long enough?

**COMPUTER ASSOCIATES**  
Software superior by design.

# dBFast™

© Computer Associates International, Inc., 1 Computer Associates Plaza, Islandia NY 11788-7000. All trade names referenced herein are trademarks of their respective companies. dBASE is a registered trademark of Ashton-Tate Corporation.

Circle 90 on Inquiry Card.



**The range of options for Internet access is almost as broad as the range of Internet resources**

**DANIEL P. DERN**

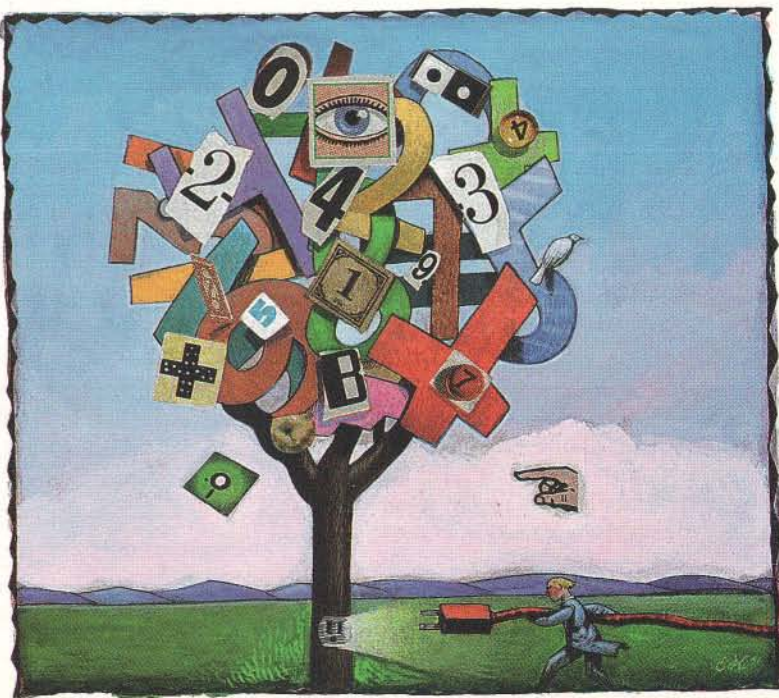
The good news is that almost anyone with a PC and modem can get Internet access in one form or another, often for as little as \$10 to \$20 per month. In fact, depending on the services you want, your current BBS and E-mail accounts may offer sufficient connectivity. At the high end, organizations such as Fortune 1000 corporations, schools, libraries, and other institutions are plugging into the Internet at speeds of from 56 Kbps to 1.554 Mbps (T1) and higher, at a cost of from several hundred to several thousand dollars per month.

The Internet is arguably the world's largest computer network, connecting thousands of sites and millions of users all around the world. Plugging into the Internet gives you real-time access to a myriad of on-line databases, library catalogs and collections, and software and document archives, as well as store-and-forward services such as Usenet News and E-mail for thousands of SIG (special-interest group) topics.

Your connection to the Internet has several dimensions. The first is whether it will be a terminal-

A terminal connection means you are using a terminal emulation package (or a real terminal) to connect to an account on a computer that is on the Internet. You open Internet connections between the host computer and remote systems. (Further steps are required to perform specific functions, such as downloading files from the host computer to your PC.) A terminal connection can support only one session at a time—namely, the terminal emulation session.

*continued*





By contrast, a network connection is capable of supporting several sessions of remote log-ins, file transfers, and other activities concurrently.

Another dimension to your Internet connection is whether you need a permanent or an on-demand connection. Many systems and LANs are connected to the Internet full-time. Others establish connections to the Internet only when needed; for example, some public-access Internet hosts will dial up a network connection only when a user request requires it.

A final factor you have to determine is whether you need access to real-time applications. Being part of the Internet means you can run real-time applications, such as file transfer and remote log-in. Many computers, networks, and services provide gateways to the Internet by supporting E-mail exchange, Usenet (the global multitopic BBS structure of newsgroups that intertwines strongly with the Internet proper), and news, without supporting the real-time Internet applications. This may be just the level of Internet access you need.

### Terminal Access

Getting on the Internet through a terminal connection has become quick, easy, and affordable, thanks to the advent of public-access Internet hosts—multiuser Unix systems connected to the Internet. If you already have a modem and a communications program, you're 95 percent of the way there.

Like CompuServe, Prodigy, and thousands of BBSes across the world, public-access Internet hosts offer accounts to anyone (see the text box "Internet Access Information" on page 156). You access the Internet hosts with the same computer, modem, and communications software that you use to dial up BBSes, CompuServe, and so on. Public-access Internet hosts, such as NetCom (San Francisco) and The World (Brookline, MA), provide you with dial-up access to their systems. You can use the full range of Internet services and resources (subject to access and usage restrictions, and you may need specific accounts for certain services). The biggest difference between a terminal connection and an IP-based one is that when accessing the Internet through a terminal, you are limited to one session at a time.

From your account on a public-access Internet host, you can make use of those Internet facilities that require real-time IP connectivity, such as FTP (file transfer protocol), remote log-in (Telnet), IRC (Internet Relay Chat), WAIS (Wide-Area Information Server), access to text data sets, library catalog access, and multiuser interactive games, such as MUD (Multiuser Dungeon). You will probably require at least a little knowledge of Unix; however, a number of these systems provide on-line help tutorials—you simply type `help` at the system prompt.

An account on a public-access Internet host costs anywhere from \$1 to \$4 per hour. Some systems have a minimum monthly charge; for example, The World charges \$20 for the first 20 hours and then \$1 for each hour after that. There may be additional charges for storing over a certain quota of files and other miscellaneous fees, but it's still a bargain. You'll also have to pay extra if dialing up the system is a toll call. Many systems have arrangements to provide slightly cheaper long-distance dial-up services.

Most of the Internet public-access Unix hosts have state-of-the-art high-speed modems and protocol suites. A 9600-bps modem is standard; you can also expect

14,400 bps with V.32bis and up to 19,200 bps with compression. (The Internet host will also provide for slower speeds—2400, 1200, or even 300 bps—if you have older equipment or noisy telephone lines.)

### Network Connections

By running TCP/IP directly on your computer or LAN and establishing a network-layer connection with the Internet, your computer can interact directly as a peer with other computers and services on the Internet. TCP/IP software is included in nearly every version of Unix and every Unix-type system (e.g., SunOS, Apple A/UX, Next, IBM AIX, and DEC Ultrix).

TCP/IP software is also available in commercial or free public domain versions for nearly every popular type of computer environment. For example, DEC, IBM, Novell, and other vendors offer TCP/IP along with their proprietary network protocols for most of their computing environments. More important, TCP/IP is available for most desktop computing systems, including MS-DOS, Windows, Mac OS, and Amiga. That's right: Even your Mac PowerBook or portable Windows notebook can connect as a peer computer on the Internet.

By running TCP/IP, you can execute Telnet, FTP, IRC, and other IP applications directly from your own computer, rather than having to dial up as a terminal. Because your connection is a full IP network connection, you can have multiple sessions concurrently (e.g., two Telnet, two FTP, and one IRC, each in its own window—assuming, of course, your CPU can handle this load).

Many of the Internet service providers offer dial-up IP connections from which you can log on and transfer files across the Internet at will. Organizations offering dial-up IP connections are called public *dial-up providers*.

If you are using an IP dial-up connection, rather than directly plugging into a LAN, your computer must also support (in addition to TCP/IP) an underlying protocol for communicating over a serial line (i.e., a telephone line). Most products you buy will include either PPP (Point-to-Point Protocol) code or its predecessor, SLIP (Serial-Line IP).

If you decide to dial in as a protocol-speaking host, you will need a location where you can receive and store your incoming mail (i.e., a network address on a system that will hold messages in its queue for you). When you dial in, you use one of the TCP/IP Post Office Protocols to connect to the mail server so that you can retrieve your messages in batch format. Once you download the messages, you can read them off-line on your system. Many commercial and public domain mail readers, which can upload outgoing E-mail you've created, are also available. Most of the service providers that offer dial-up network service also offer mail queuing; if not, you'll need to find a site that will act as your mail drop. Similar arrangements, protocols, and programs are available for browsing, downloading, and posting to Usenet.

If your organization wants full-time, full-capability Internet connectivity—meaning using leased-lines to connect its LANs or backbone to the Internet—you should first check with an Internet service provider in your area. There are dozens of regional, national, and international Internet service providers.

### Choosing Your Connection Mode and Provider

A number of factors need to be considered to determine the most appropriate mode

### Types of Internet Connections

- Dial-up terminal-style connections to Internet hosts.
- TCP/IP network connections between your computer and the Internet.



# Locating Internet Access in Europe

MERIK VOSWINKEL

**T**he main network in Europe that delivers full Internet to its 1500 sites is EUnet, sometimes referred to as interEUnet. Of these 1500 sites, only a few offer public access, some on a commercial basis and some as an informal service to a few people outside their organization. Some sites specialize in providing the Internet to a company LAN. These solutions are costly and often require the purchase of an expensive router and an ISDN or leased line. These connections can cost up to \$10,000 or more per year. Most public access, however, is geared to a dial-up modem, an X25, or ISDN connections.

To establish an Internet connection, you first have to locate a site near you, preferably in your local calling area to keep the telephone cost minimal. Often a visit to the computer store of a local university or a call to a member of the computer science faculty will tell you who is offering Internet access in your area. Many times the university will itself be a supplier and offer reasonable fees. However, universities sometimes refuse business clients and refer them to public-access sites.

Visiting a university is often a great way to get started; you get to look over the shoulders of people while they're using the Internet. Most are evangelists to the Internet cause and will gladly offer help and advice. It is also a good place to get configuration (public domain) software and learn lots of tricks from experienced users who are sitting at the same computer that you plan to use to access the network. Internet access can take weeks to master. Dialing up a Unix computer and customizing the log-in to make it work with your terminal software and modem at home can be a daunting task for most users. In Europe, most public Internet sites don't yet have customer support to lead you through the process.

A quick way to locate an Internet site that will provide you with a connection is through the Internet itself. If you know someone with E-mail access to Internet users, you can search for a site that has

the best options. Most non-Internet E-mail services can also send mail to the Internet, sometimes after adjusting the E-mail address slightly. Shopping around with E-mail can also be useful for changing your site if you want to take advantage of better types of connections. KnoWare has gathered a list of the main European sites that offer Internet access on a commercial basis. To get this list, you can send an E-mail request to [creon@accucx.cc.ruu.nl](mailto:creon@accucx.cc.ruu.nl).

You can get access information from the main Internet site in any European country. You simply send a message with your request for a local Internet access. The main Internet site can answer your request, or it can pass the request on to a provider. The E-mail address you use in Europe is [postmaster@\[countryname\].eu.net](mailto:postmaster@[countryname].eu.net). You have to fill in the country name with the English-language name of your country. All the European Community countries are represented (i.e., Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the U.K.), as well as others (e.g., Austria, Finland, Iceland, Norway, Sweden, Switzerland, and Yugoslavia). You should use this address only if needed, so as not to overload the European postmasters.

Another way to locate a local supplier is on the Usenet News, the conferencing area of the Internet. Main non-Internet BBSes carry these newsgroups. You should read the groups [alt.internet.access.wanted](mailto:alt.internet.access.wanted), [news.new-users.questions](mailto:news.new-users.questions), or the older [alt.bbs.internet](mailto:alt.bbs.internet). You can post requests here for the name of a local supplier. Commercial sites scan these groups, and they sometimes contact you if you state your mail or E-mail address.

If all else fails, you can order a list of 1500 sites from the EUUG Secretariat, Ownes Hall, Buntingford, Hertfordshire SG9 9PL, U.K., 44-763-73039, E-mail [euug@nic.eu.net](mailto:euug@nic.eu.net). The problem with this list, however, is that it does not mention if a site offers public access.

Public sites often have a better ser-

vice for novices, while universities lean more toward computer-literate users. Public sites offer more options geared to dial-up access, while universities consider their campus networks their main target.

The Internet offers many services, but its main use is for E-mail, news, and FTP (file transfer protocol), as well as to request remote log-in (Telnet). The type of access that your site offers can limit you in these options. Some services give you a terminal connection to a Unix host. Your terminal connection can be via shell access, (anonymous) UUCP feed, or BBS software. This connection offers you E-mail, news, and sometimes FTP and Telnet.

Direct connections make you a node on a service provider's LAN, so you can run all your software on your own computer. You can connect directly with SLIP (serial-line IP) or PPP (point-to-point protocol) over a modem to the Internet WAN (wide-area network) or make a direct Ethernet connection to the Unix hosts. A recent development for Macintosh computers is the capability to connect with ARA (AppleTalk Remote Access) and MacTCP to the Internet. You need public domain programs such as Eudora for E-mail, TheNews or News-watcher for news, and Fetch or Xferit for FTP. You can use Telnet to log into computers over the network. Several sites are offering similar solutions for MS-DOS, Amiga, Atari, and Unix workstations. These solutions are recent developments, designed by the Internet community for use over Ethernet networks. Public-access providers extend this network to your home with SLIP, PPP, or ARA. It makes the Unix-oriented Internet much easier to use, even by novices.

*Merik Voswinkel is president of KnoWare (Utrecht, The Netherlands), a firm providing public Internet access. He works as a Mac and Internet consultant in the nonprofit sector. You can contact him on BIX c/o "editors" or on the Internet at [creon@accucx.cc.ruu.nl](mailto:creon@accucx.cc.ruu.nl).*



# Space - Savers

## Popular Space-Saver Keyboard £79.00



First successful alternative to conventional keyboard saves 60% desk space with a foot print of 27.3 x 15.2 cm. Has full travel tactily responsive keys with standard left-right spacing for easy touch typing. 100 keys, compatible with IBM XT/AT PS/2. Many language versions available.

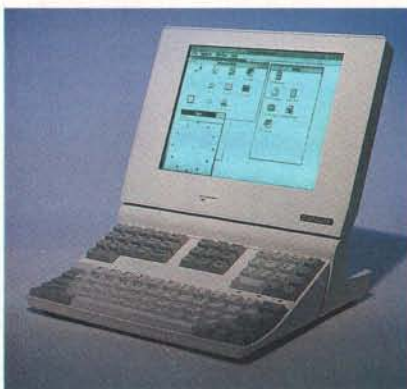
## Stand-Alone LCD Monitor £799.00



This 10" black on white monitor is easy-to-read, yet compact. Resolution is 640x480 with sharp, flicker-free image. Sharp's high refresh rate, triple supertwist nematic technology with back lighting provides a super bright, low radiation screen with a wide viewing angle. The adjustable monitor base is only 29x14 cm. It lets you mount the LCD monitor on vertical surfaces or fold for transport. Comes with 1.5 m cable and VGA adaptor card. No external power required. IBM AT compatible.

**NEW**

## Diskless LANStation £1599.00



Combines Space-Saver Keyboard, LCD Monitor and 20 Mhz 386sx CPU w/2 Meg RAM (4 Meg optional) in a single very small footprint (27.4 X 26.0cm). Network ready with 10 Base2, 10 BaseT NE-2000 compatible network adapter built-in. Unit does not fold for portability.

**To Order In Europe Call 44-306-876718  
Fax 44-306-876742**

1 year warranty on all products shown. Order direct from stock with 15 day full return privileges. Visa, Master/Eurocard charges and COD accepted. OEM and reseller volume discounts available.

Also Stocked & Serviced in: AUSTRALIA Tel 2-908-2777 • Fax 2-908-2331

# DATALUX

## First Choice In Space-Saver Peripherals

Euro House • Curtis Road, 11 Old Water Yard • Dorking, Surrey  
UNITED KINGDOM, RH41EJ • Phone 306-876718 • Fax 306-876742

## PLUGGING INTO THE INTERNET

and provider for your connection to the Internet: Do you require remote log-in and file transfer? Or do you need services and applications that require real-time IP connection, such as WAIS and HYTELNET? Perhaps you require just an Internet E-mail link or Usenet News. The level of service that you need goes a long way toward determining the type of service you require.

Other considerations include the type of computer you'll be using and the types of connections your computer supports. It is much easier to get a Unix machine outfitted with a TCP/IP stack than it is to do the same with a DOS machine or an Amiga. Where you live is as important as the type of machine you'll use. If you're out in the country, telecommunications costs can make real-time IP access prohibitively expensive.

A direct IP connection is the most powerful and flexible solution, but it is also the most expensive to set up and maintain; thus, it is better for organizations than for individuals. A dial-up IP connection is best for an individual who needs the flexibility of multiple sessions. For people not at an Internet site, terminal access is often the most cost-effective solution to the Internet-access dilemma.

### Indirect Connections

In addition to the direct connections listed above, there are several indirect ways for you to connect to the Internet or access its resources and community. First, you can get a dial-up terminal-type account to a Unix/Usenet BBS that is not directly on the network. Hundreds of dial-up Unix-based BBSes are all over the world and can be more accessible (and affordable) than the Internet hosts or service providers. If you primarily want E-mail, Usenet News, and archives but don't need real-time IP connection, BBSes may be good enough. In addition to providing an E-mail connection to the Internet, many BBSes include full Usenet News feeds and gigabytes of popular software archives (which are beginning to be distributed via CD-ROM). A number of other files can be retrieved via E-mail-based file transfer.

Other indirect ways for you to access the Internet are having an account with an Internet E-mail provider (i.e., an E-mail service directly on the Internet). Many of these providers offer 800-number access or an account with a commercial E-mail/BBS provider that has an E-mail gateway to the Internet, such as ATT Mail, CompuServe, and MCI Mail. Finally, you can download software from UUNET at (900) 468-7727 for 50 cents per minute (you just log in as UUCP, and you don't need a password; UUNET modem speeds are up to 19,200 bps with PEP protocol).

### A Few Words About "Netiquette"

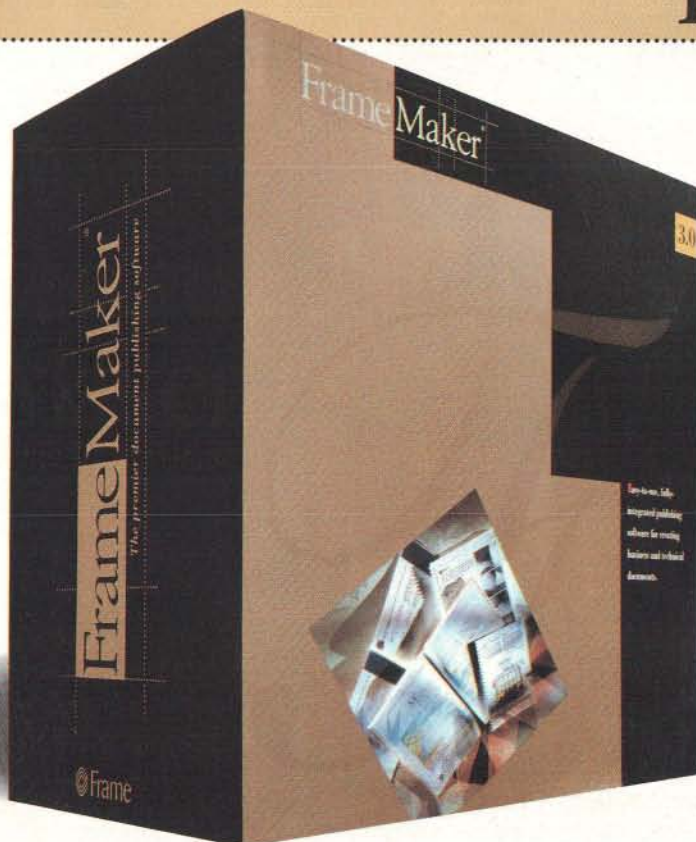
It is important to be aware that when you access the Internet, you are connecting into a large global community and to a vast network of resources. As a reminder to Internet users, Charlotte Moore of BBN Communications says, "The Internet allows you to contact thousands of systems and hundreds of thousands of users in a single act, deliberately or unintentionally, so it's important to be aware of who's paying for your use of Internet resources, and how much it costs."

More specifically, here are a few canonical tips to prevent your Internet usage from becoming disruptive. First, you should be careful how you use FTP and Telnet: You should try to use them during off-peak hours and not tie them up for too long. Second, you should use discretion: Don't send E-mail messages to a newsgroup or post anything you wouldn't be willing to see on the front page of tomorrow's newspaper. Finally, you should be sure to



# ► FrameMaker.

## The ultimate Interleaf® "upgrade."



Year after year you Interleaf users hoped for a newer, friendlier, better publishing solution—and what you got were promises.

► What you ought to get is FrameMaker.\*  
 ► With FrameMaker you'll get a document publishing program that's powerful, fully featured, and fully integrated—like Interleaf. But not fully frustrating—like Interleaf.

► You'll get a familiar, well-behaved user interface that increases your productivity, instead of a proprietary interface that increases your confusion. You'll get accessible, intuitive tools like FrameMaker's Conditional Text, instead of cumbersome, procedure-intensive nightmares like Interleaf's "Effectivity."

► You'll finally get files that are truly compatible—across all the major desktops and across future upgrades. Instead of Interleaf version 5 on your Sun™ that can't

be handled by Interleaf version 3 on your Macintosh.

► You'll get the same compatibility with FrameViewer,™ Frame's leading edge viewing technology that lets you distribute FrameMaker documents—or even converted Interleaf documents—electronically. So everyone in your organization can receive up-to-the-minute, accurate information on-line.

► And if you act quickly you'll get an even easier upgrade deal: a **free** Interleaf-to-FrameMaker file conversion filter\*—a \$995 value.\*\* Call **1-800-U4-FRAME Ext. 233** today for more information. And this time upgrade for good.




# Frame®





**XVT**  
Release 3  
Now Available!

It's true! You can write your application just once in C or C++, and link it with an XVT library to get a native application for the GUI system of your choice. Not only have we been shipping XVT for over 4 years, but our customers are shipping their applications, too! Call today for full details, including a free XVT Technical Guide.

XVT Software Inc.  
Box 18750, Boulder, CO  
80308 USA  
303 443-4223  
FAX 303 443-0969



XVT is a trademark of XVT Software Inc.  
Motif, OPEN LOOK, Macintosh, MS-Windows,  
and OS/2-PM are trademarks of their vendors.  
\* OPEN LOOK available in Fall 1992

## You can develop portable GUI applications with XVT!

for:

- Motif
- OPEN LOOK
- Character Displays
- Macintosh
- MS-Windows
- OS/2-PM

## PLUGGING INTO THE INTERNET

keep your password secret and report any possible security violations to your system administrator or other appropriate site personnel.

### Getting More Internet Info

Even if you are an experienced Unix hand, you may be bewildered by the vast array of resources available through the Internet. One of the best places to get information is on the Internet. There are lots of "how-to" write-ups available on-line in ASCII and PostScript versions. Many sites and network service providers have their own user guide, and several general guides are available as well. Explore your system for on-line help files and programs, and ask your site contact personnel about training seminars.

Several resource books are available: Some are very basic, and some are focused on specific areas such as library catalogs, databases, and computing resources. New resources come up on the Internet almost hourly. In general, the more you make use of Internet resources, the more you'll be able to figure out how to use them and learn about new ones—and the more you'll get out of being on the Internet. ■

*Daniel P. Dern is a freelance technology and business writer based in Newton Center, Massachusetts. He is the author of The Internet Guide for New Users (McGraw-Hill, forthcoming). You can reach him on BIX c/o "editors" or on the Internet at ddern@world.std.com.*

## A MESSAGE TO OUR SUBSCRIBERS

FROM TIME TO TIME WE MAKE THE BYTE SUBSCRIBER LIST available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

**BYTE** Magazine  
Attn: Subscriber Service  
P.O. Box 555  
Hightstown, NJ 08520



## Internet Access Information

### Internet service providers

For a list, contact:

NNSC (NSF Network Service Center)  
BBN Laboratories, Inc.  
(617) 873-3361  
Send E-mail to  
info-server@nnsf.net  
and include in the message:  
request: nsfnet  
topic: referral-list  
topic: help  
request: end

For a list of providers for dial-up IP, include topic: other-providers

### Public-access Internet hosts

For a list, send E-mail to kaminski@netcom.com with "Send PDIAL" in the subject field

Digital Express Group  
(301) 220-2020  
fax: (301) 345-6017  
info@digex.com

NetCom, Inc.  
(408) 554-8649  
info@netcom.netcom.com  
(terminal and SLIP access)

Panix  
(718) 832-1525  
info@panix.com

The World Software Tool & Die  
(617) 739-0202  
modem: (617) 739-9753  
info@world.std.com

### Unix BBSes

For a list, send E-mail to nixpub@digex.com (no subject or message text)



# The Monitors for Windows

The ViewSonic 7 was the original, "Big Screen for Windows" monitor. Here's what some editors said about it:

*Byte (May 1992) "... The ViewSonic 7 gets our vote as the best overall monitor".*

*Windows Magazine (May 1992) "... The ViewSonic 7 is the best value in the test".*

*Infoworld (Sept 1991) "... The ViewSonic 7 captured the top spot in our tests".*

## Introducing the NEW 14" ViewSonic 5E and the 15" ViewSonic 6FS.

The best of both worlds ... ideal Windows monitors to fit the size and budget requirements of every customer.

## Now you have a choice.

These three great non-interlaced monitors have a lot in common, including minimum 72Hz refresh rate at 1,024 x 768 resolution. That's flicker free. Plus they're multi-scanning and have a non-glare screen.

The 15" and 17" monitors feature a flat square screen along with digital controls for programmable screen adjustments. To help maintain a safer environment, both are MPR-II certified for low radiation.

For the monitor that's best for Windows, make it a ViewSonic — the monitor of choice. And you have a choice of three!

## ViewSonic®

20480 E. Business Parkway  
Walnut, CA 91789  
(714) 869-7976 (800) 888-8583  
FAX (714) 869-7958

All products and brand names are trademarks of their respective companies.

**Circle 188 on Inquiry Card (RESELLERS: 189)**

**COMPACT 14" ViewSonic 5E**



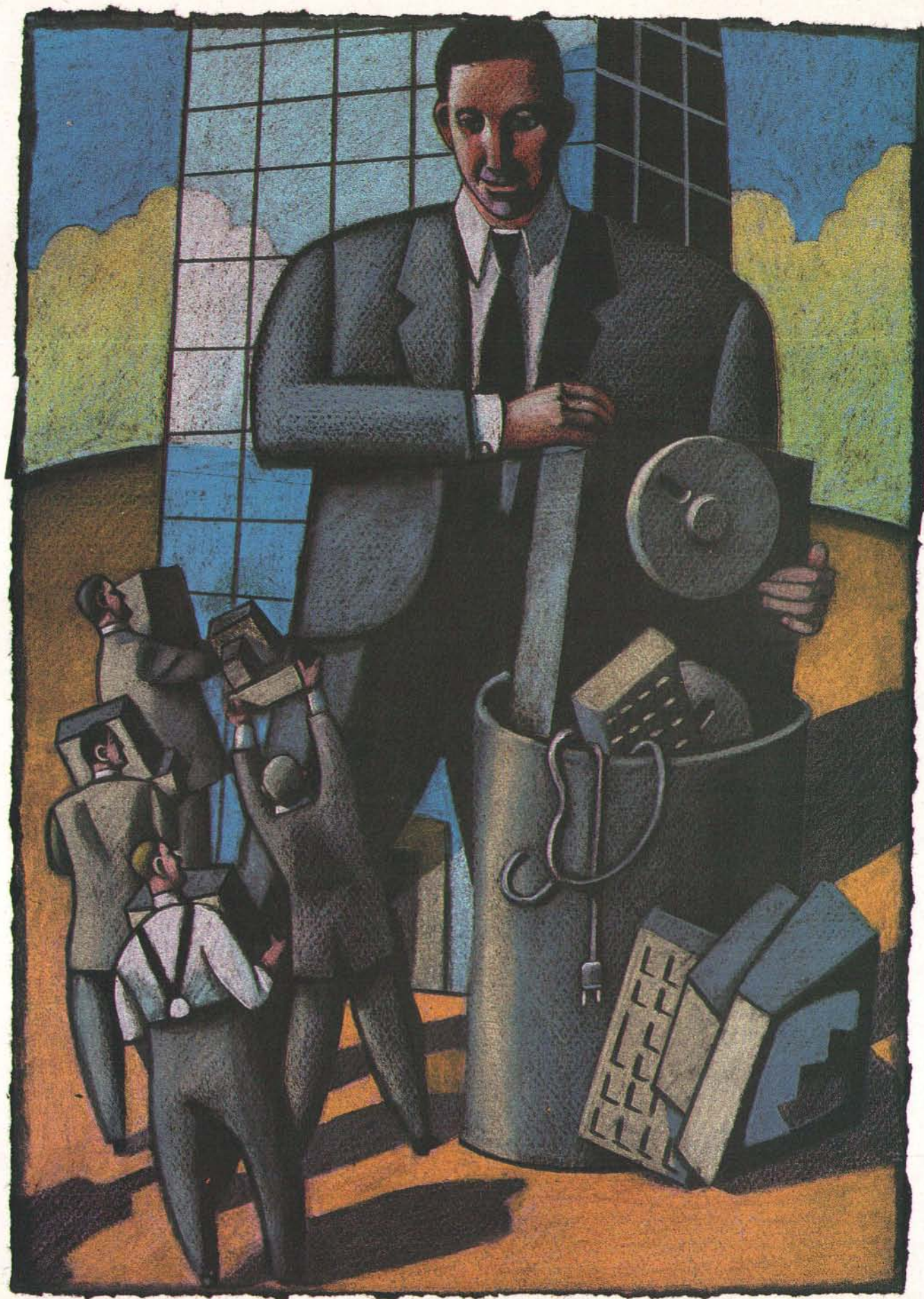
**MID RANGE 15" ViewSonic 6FS**



**FULL SIZE 17" ViewSonic 7**









# OPERATING-SYSTEM TRENDS

Business users raise the expectations of desktop-based operating systems

JOHN DONOVAN

A few years ago, all it took for an operating system to gain acceptance was an inexpensive hardware platform and a good application base. Now more complex factors come to bear: How easy it is to use and to develop applications for? How stable is its technology base? Driving this change is the trend among businesses to downsize. These companies are abandoning their minicomputers and mainframes for networked desktop systems. The personal computer is proving itself capable of handling mission-critical tasks, but the corporate customer wants more.

The sophisticated operating systems of mainframes and minicomputers (e.g., DEC's VMS or IBM's MVS) support multitasking, virtual memory, security, robust file systems, and efficient system administration. All these features are incorporated into each of the desktop-based operating systems discussed in this State of the Art section. These operating systems—Microsoft's Windows NT, IBM's OS/2 2.0, Apple's System 7.0, Univel's UnixWare, Next's NextStep, and SunSoft's Solaris—combine the best of the mainframe/minicomputer world with the best of the desktop world. The result is a relatively bulletproof system designed to be implemented on a large scale and able to run familiar desktop applications with a familiar user interface.

In competing for the corporate customer, hardware has become a commodity, and the operating system has become the vehicle for the competition. The latest manifestation of how the operating system is the focus of the competition for the corporate customer is found in Microsoft's Windows.

## The Server Is the Key

Windows covers a wide range of systems, from notebooks and pen-based computers to the desktop. Originally, Windows was intended to make it easier for people to use the PC, but recently, it has expanded its mission: to form the foundation for a better server in client/server computing through NT (see "Windows NT Up Close" on page 167). Mike Nash, NT marketing manager for Intel, describes the operating system as "kind of a best-of package. If you name all the things

you would want out of Unix, VMS, OS/2, DOS, and Windows, you will find they're all in NT." If it sounds like it's being developed as an ideal operating system for the server, that's because it is. All the serious operating-system contenders are vying to succeed in the corporate market by capturing the server.

The server is a key to operating-system marketing strategies because corporate networks are typically made up of a mix of clients: Accounting might use PCs while the marketing staff has Macs and the engineering department uses Unix-based workstations. That mix is slow to change because existing equipment and their applications tend to be preserved whenever possible. So, the developer has a better chance supplying operating systems on servers and letting the operating system's performance speak for its usefulness on new client machines. Witness the multiplatform support adopted by operating-system developers (see the figure).

## Don't Forget the Developer

Another strategic target in the operating-system competition is the applications developers in large corporations. These developers are the focus of two

## Operating-System Trends

BY JOHN DONOVAN

158

## Windows NT Up Close

BY JON UDELL

167

## OS/2 at the Crossroads

BY MARK MINASI

179

## The Future of System 7.0

BY TOM THOMPSON

182

## GUIs, Applications, and Unix

BY MARY HUBLEY

186

## NextStep: The Sleeper

BY TOM YAGER

190

## Univel's Trim Unix

BY MATT TRASK

192

## Resource Guide: NEXT-GENERATION OPERATING-SYSTEM APPLICATIONS

195



conflicting pressures: downsizing (and the scattering of corporate information system resources) and the increasing need to develop applications faster. The beleaguered developer presents a critical support issue and a strategic opportunity to operating-system vendors. The operating system that best supports internal developers has a real edge in getting their company's business.

"One of the biggest problems you have in corporate America is getting an application developed," observes Mike Colleary, IBM's marketing manager for OS/2. "Corporations need applications that give them a competitive advantage, something that everybody and his brother can't buy off the shelf." According to Colleary, up to 2 million people worldwide are developing unique applications within companies. Naturally, he sees OS/2's strength as a development platform.

## Support Is Critical

Once an operating-system vendor has set its sights on mission-critical applications and corporate information systems, it must address a number of complex issues—issues that historically have had little to do

## Operating systems that best support internal developers have a real edge.

with technology. This implies a higher level of support for the customer than simply delivering a shrink-wrapped software package. The catch is that while corporate customers may demand premium levels of support, they also demand low prices. The challenge for the operating-system developer is to define a collection of capabilities that can reduce the cost of support without overburdening the operating system.

IBM's Colleary claims that that profile of the user is the model on which to build a support infrastructure. He says the op-

erating system should be as transparent to the user as possible and offer accessible help functions.

This is a new paradigm. Corporate customers are accustomed to having fast, effective, and comprehensive service and support from mainframe and minicomputer vendors. When something goes wrong with mission-critical applications, they expect a fast solution.

Arun Taneja, vice president of marketing for Univel, predicts that "the guy who is going to provide that cradle-to-grave service is the one that is going to win in terms of satisfying the MIS community and satisfying the Fortune 1000 community." Univel is targeting the systems integrators and system hardware OEMs as well. Taneja says that all the largest systems integrators are working with NetWare and are familiar with Unix, a situation that greatly improves Univel's chances of acceptance for its desktop operating system, UnixWare.

## Corporate Change

Most corporate customers are no longer dazzled by the technology of desktop systems. They've traveled the path of the PC

## UNIX Developers!

# The only dongle smart enough for any open systems application.

## Introducing MicroSentinelUX

It's simply the ultimate tool for providing developers more revenue generating options — and ensuring that you get paid for software that's used.

In fact, it is the most effective hardware key for open systems and UNIX applications. And it works on any hardware platform.

## A Hardware Key With Brains

The real magic of MicroSentinel is its onboard intelligent micro-processor. This makes the key smart enough to provide the ultimate in cross-platform flexibility and marketing value. Each key features an algorithm

and 32 bytes of non-volatile read/write memory. This allows the developer to customize the key for specific applications.

## Cross-Platform Flexibility

MicroSentinelUX is flexible enough to be used as a portable host-ID on Sun, DEC, Silicon Graphics, Apollo, HP, even PCs and more. The key attaches to any RS-232 port and the software is instructed to look for it. Its operation is transparent to the user. Developers use it to control distribution, meter usage, count concurrent users, and much more. And, it's easy and quick to integrate into your application.

## Try One Today.

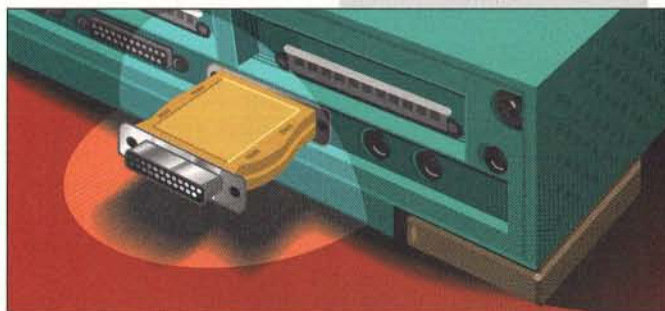
Be smart. Order a low-cost evaluation package today from the UNIX specialists at world leader Rainbow Technologies.

**SENTINEL**  
Securing the future of software

Call for more information:  
**1-800-843-0413**

## Look what MicroSentinelUX can do for you.

- Make demos and leases more secure
- Controls distribution
- Provides alternative to host-ID security
- Allows portability
- Manages site licenses
- Protects unauthorized use or duplication
- Update/upgrade software remotely



**RAINBOW**  
TECHNOLOGIES  
MICROSENTINEL HEADQUARTERS

9741-I SOUTHERN PINE BLVD., CHARLOTTE, NC 28273 ■ 704/523-9500 ■ fax 704/523-7651  
MicroSentinelUX is a trademark of Rainbow Technologies, Inc. All other products and brand names are trademarks of their respective owners.



*Look on the bright side.  
We know our data's  
going to survive.*

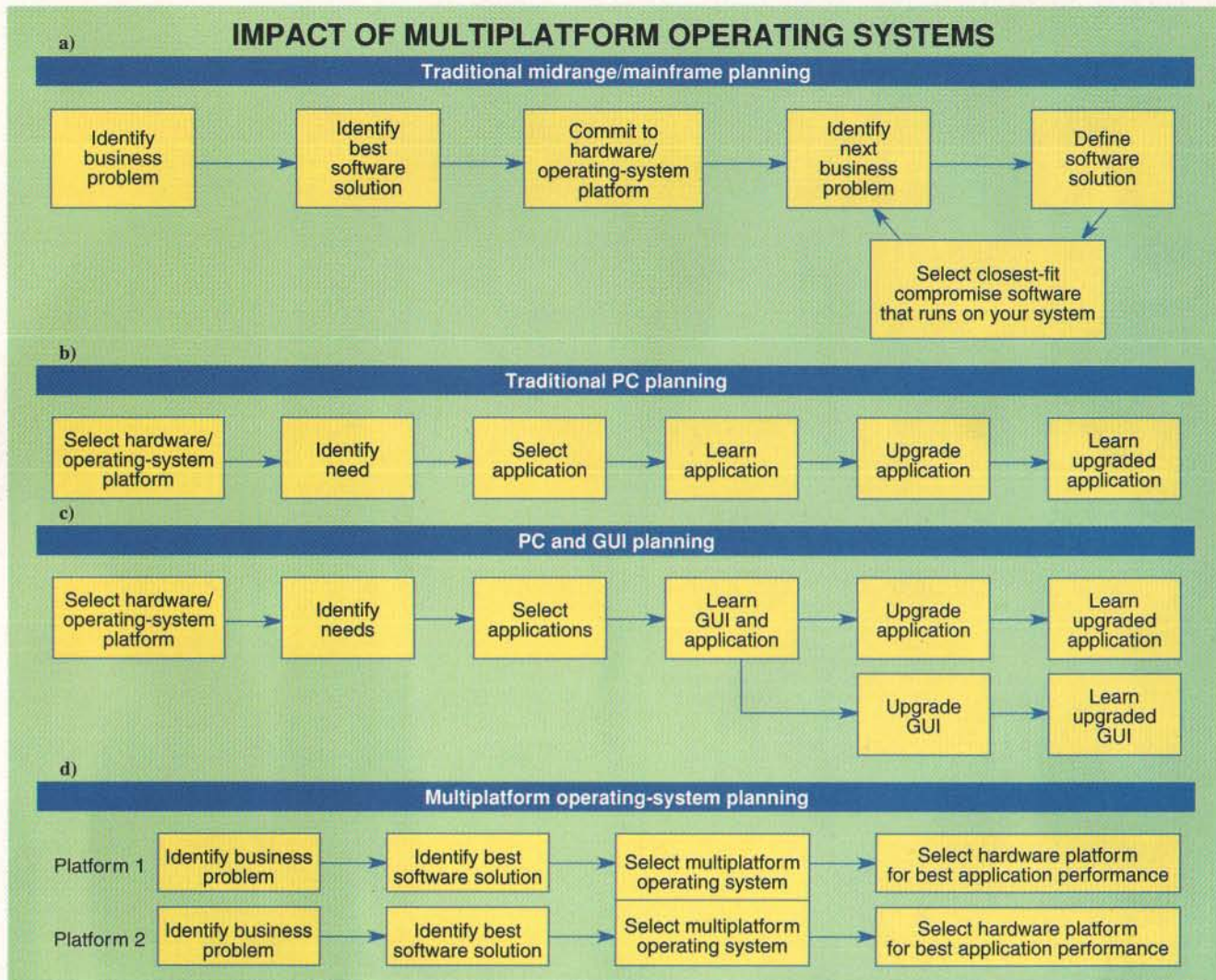


Verbatim® tapes, optical and floppy disks. Your best defense against data loss.

Circle 186 on Inquiry Card.







(a) In the traditional midrange or mainframe world, information systems planners were forced to commit to one operating system and hardware architecture early in the life of the system. Their future choices of software were limited by what was available on their chosen platform. Often that meant that the software was not the best available but the best available for their platform. (b) With traditional personal computers, the breadth of applications available made better choices of applications possible, but each application had its

own learning curve. User training became a significant issue in large organizations, and resistance to needless upgrading of applications became common. (c) The arrival of the GUI on personal computers eased the training problem by providing a more intuitive user interface that was consistent across many applications. (d) The impact of the multiplatform operating system on information systems planning will be to let customers first choose the application that best serves their needs and then choose the most efficient hardware platform to support it.

evolution (see the table). These customers are no longer looking for raw technology; they want efficient tools. Corporate customers expect their tools to work consistently and at the least possible cost in time, effort, and money.

The current wave of what is variously referred to as *reengineering*, *rightsizing*, or *downsizing* has one immediate goal: to reduce the cost of doing business. Downsizing directly affects the development of operating systems by the changes it makes in both the information systems infrastructure and the expectations of the people

who own and use those systems. The other key motive behind corporate downsizing, heard most often from those users who prefer the term *reengineering*, is the flexibility that it offers.

The infrastructure of corporate information systems, at least for the purposes of this article, can be viewed from three perspectives—what it does, who supports it, and who pays for it. The move in recent years from mainframe-based information systems to those based on minicomputers and microcomputers was a user revolution driven by cost (primarily of the com-

puting hardware), freedom (of information access and exchange), and focus (the mainframe-based information system focused on corporate-level problems, often ignoring department-level problems).

## It's Gotta Be Multiplatform

Changes in information systems have driven corporate users to clamor for technical solutions to their problems. When there's less money and fewer people to throw at problems, what's left but technology? One of the technical solutions that corporate users are now asking operating-system



# LAUNCH YOUR HARD DRIVE!

*Promise  
Introduces  
the First  
Truly  
Affordable  
Caching Disk  
Controllers.*

## Prices Start at \$129.00

Order an IDE Caching Controller today and watch your system operate at light speed!

## Featuring

- .3ms Average Disk Access Speed.
- "Plug and Play" Operation.
- Easy to Follow Documentation.
- Two Year Warranty.
- Guaranteed to Run with All Operating Systems & Applications Software.

*Our new ultra-low cost disk accelerators will finally end the data bottleneck that takes up so much of your valuable time and at a fraction of the cost of similar cache controllers. They install in minutes and require no special tools or expertise. Satisfaction guaranteed!*

“If you're tired of watching your hard drive slowly give up its data, Promise Technology may be able to put the spring back into your data handling... There are other caching IDE controllers available, but they don't share the flexibility and simplicity of the DC-2032. These two attributes will make it a sterling addition to your computer.”  
*Bill O'Brien, PC Sources.*

“★★★★ An enormous improvement in performance was immediately obvious compared to the un-cached controller... Overall, this controller increased performance by a factor of around 8 times when using large database applications. At a more general level, the whole machine seemed faster and more responsive... At the new lower price, this is an extremely good value and extra features make this controller (DC-2031) a particularly attractive option.”  
*Dave Pearman, PC+ (U.K.) March '92*



**OEM and Dealer  
Inquiries Welcome.**

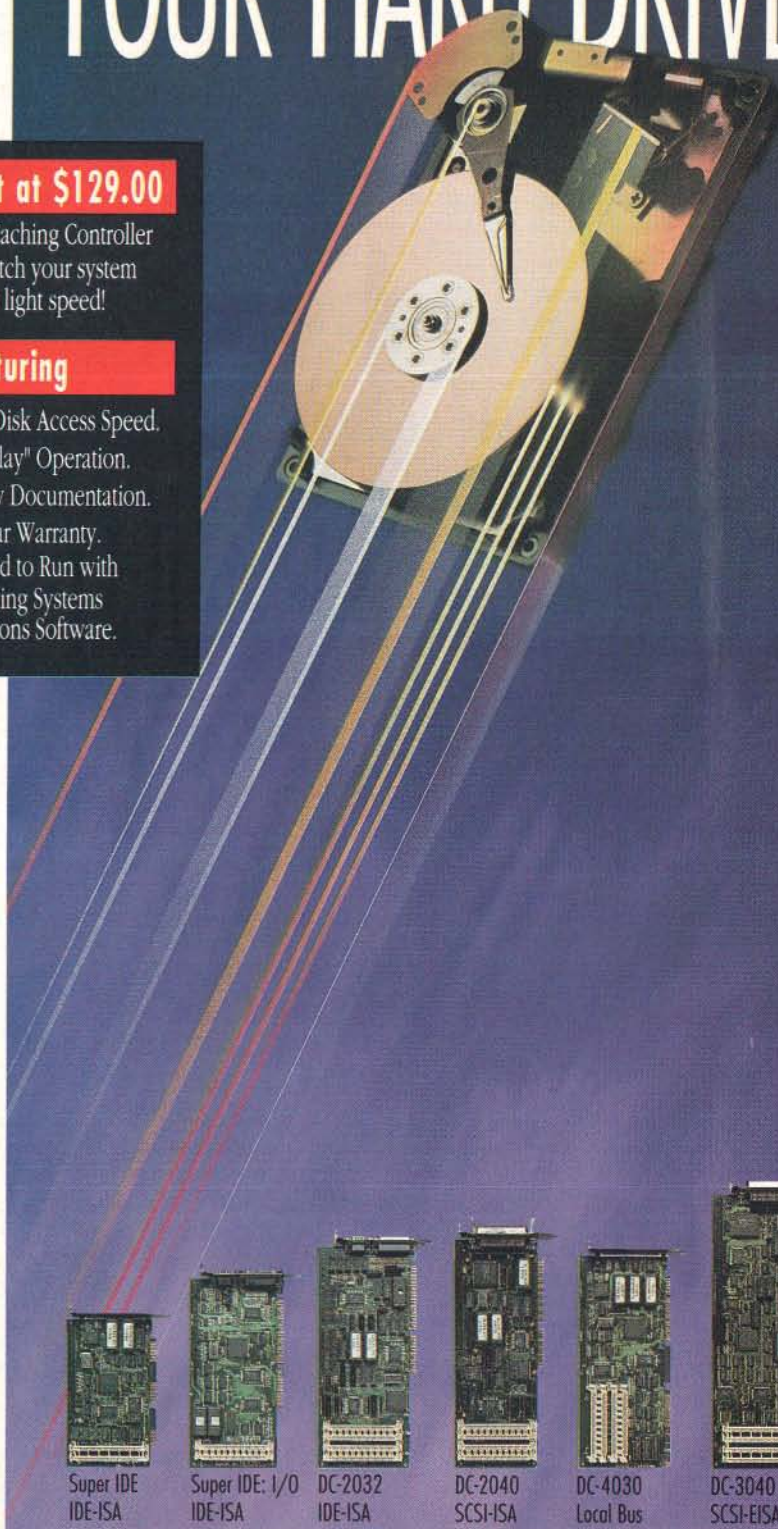
ITALY: Executive di Ascoli (39) 0341-282614	GERMANY: CPS (49) 040-656-998-0	U.K.: Dan Technology (44) 081-902-9922	FRANCE: HTS (33) 042-20-59-59
SPAIN: Mega Micro (34) 01 571 42 75	DENMARK: Dancotek (45) 044 44 03 22		

**Toll Free in USA  
1-800-888-0245**

Hard drive depicted is the Maxtor LXT535 IDE drive.  
Provided courtesy of Maxtor Corporation.

**PROMISE  
TECHNOLOGY, INC.**

1460 Koll Circle, San Jose, CA 95112  
Tel. (408) 452-0948 Fax (408) 452-1534



Super IDE  
IDE-ISA

Super IDE: I/O  
IDE-ISA

DC-2032  
IDE-ISA

DC-2040  
SCSI-ISA

DC-4030  
Local Bus

DC-3040  
SCSI-EISA



## THE DESKTOP EVOLUTION

*The evolution of the desktop has to be viewed from the directions of the user, the hardware, and the typical applications and data handled. The earliest PCs were clearly desktop machines for the computer programmer. By the mid-1980s, the PC had become an execution platform for stand-alone applications, with a greater emphasis on ease of use. The PC of today is still mainly an execution platform (now for the GUI), but the productivity gains it enables have gone beyond the single user to benefit workgroups. By the mid-1990s, the desktop system will be well along in the transition from a personal data-processing station to a personal information-access station.*

	1982	1985	1992	1994
<b>CPU</b>	8088	286	486, 68040, RISC, and SPARC	P5, RISC, and multiprocessors
<b>Storage</b>	Floppy disk	Hard disk	Large, centralized hard disk	Large hard server
<b>Video</b>	Black and white or CGA	EGA	24-bit color	24-bit color
<b>User interface</b>	Command line	Pull-down menus, command line, and private resources	GUI, local single user, workgroup user, and shared resources via LANs	GUI; virtual workgroups; shared applications, data, and resources network; and personal, location-independent desktop
<b>Applications</b>	Single-task oriented, Lotus 1-2-3, and word processing	Graphics use growing, Lotus 1-2-3, word processing, DBMS, and TSR utilities	Graphically oriented, multitasking, use of TSRs, data sharing/linking, word processing, spreadsheets, DBMS, presentation graphics, communications, and custom-made mission-critical applications	Multitasking, agents, document-based, mission-critical applications common, and video conferencing
<b>Data</b>	Text and numerical files; simple graphics; updates via sneakernet; and files over 100 KB considered huge	Text and numerical files, more sophisticated graphics, and more emphasis on the presentation of data	Graphically presented, accessed via LANs, and some sound	Search by content, remote access, and multimedia

developers to provide is the multiplatform operating system.

Operating-system developers can no longer afford to support just one hardware platform. A successful sale of personal computers to a large installation represents big revenues to the operating-system developer—too big to be tied to the fate of any one hardware platform.

### Network-Dependent Applications

As you migrate from a simple PC on a desktop running only personal productivity applications to enterprise-wide systems, each level adds user benefits. From a technology viewpoint, the transitions between these levels can be achieved through incremental additions. But from the corporate customer's perspective, each level adds other issues that a mission-critical system must address.

For an application in a networked environment to be robust, all the network's resources must be managed. It becomes a more difficult and costly implementation

process. For advanced operating systems, the key question that network-dependent applications raise is, How much of that network management responsibility should the operating system assume?

The operating system forms the foundation of the networked environment, and the system management functions (e.g.,

configuration, installation, and administration) become applications that lie on top of the operating system. But the operating system must be tailored to support network-dependent applications.

Information systems professionals are accustomed to having the access and controls that are provided by large host environments. What they are looking for is a stable operating system on the server and a stable, multifunctional operating system on the client. They want applications built on top of an operating system so that they can manage the networked resources easily.

For example, Colleary points to OS/2's Crash Protection feature, which protects the networked system from massive failure in response to an application crashing on a client. If an application running on a client pulls down your entire system, "you're not talking about a person being unable to work, you're talking about the entire organization or department not being able to function," Colleary says.

### Corporate operating-system requirements

- Ease of use
- Ease of application development
- Multiplatform support
- Support for legacy applications
- Familiar user interface
- Stable technology base
- Security
- Vendor service and support
- Ability to work in a distributed environment
- Efficient system administration

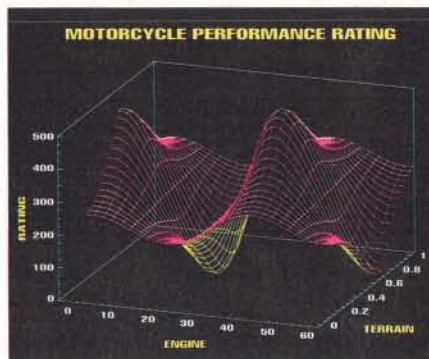




## We've Added Extra Power To An Already Great Ride. New STATGRAPHICS *Plus* Takes You Farther.

YOU DON'T HAVE TO BE  
AN EXPERT TO HANDLE  
NEW STATGRAPHICS *Plus*  
FOR THE 386/486.

If you've been wheeling around statistics for any time at all, you probably already know about STATGRAPHICS®, the statistical graphics system that anyone can use to quickly analyze data and see the results. The package that offers over 250 different statistical procedures, including regression analysis, ANOVA, quality control, experimental design, multivariate methods, forecasting, and much more. The product that Software Digest rated #1 for ease of use and learning. Now, we've done the only thing left to improve it: we've added all the horsepower you could want.



### THE POWER AND SPEED FOR THE FAST TRACK.

If you've got a 386- or 486-based PC, grab your racing helmet. Because anything STATGRAPHICS can do, STATGRAPHICS *Plus* can do up to 5 times faster. And since it utilizes all of the RAM in your computer, it can handle the largest problems, including those that other stat packages

choke on. And everything in this powerful new product works just like in STATGRAPHICS, right down to its easy-to-use menus and ability to import data from Lotus®, dBASE®, ASCII, or DIF files.

### THINK OF IT AS A BETTER WAY TO SEE THE BIG PICTURE, FASTER.

Call today for more information and a free demo disk. And let STATGRAPHICS *Plus* keep you from spinning your wheels waiting for solutions.

## STATGRAPHICS

In Maryland, (301) 984-5123.  
Outside the U.S., (301) 984-5412.

**(800) 592-0050 Ext. 400**

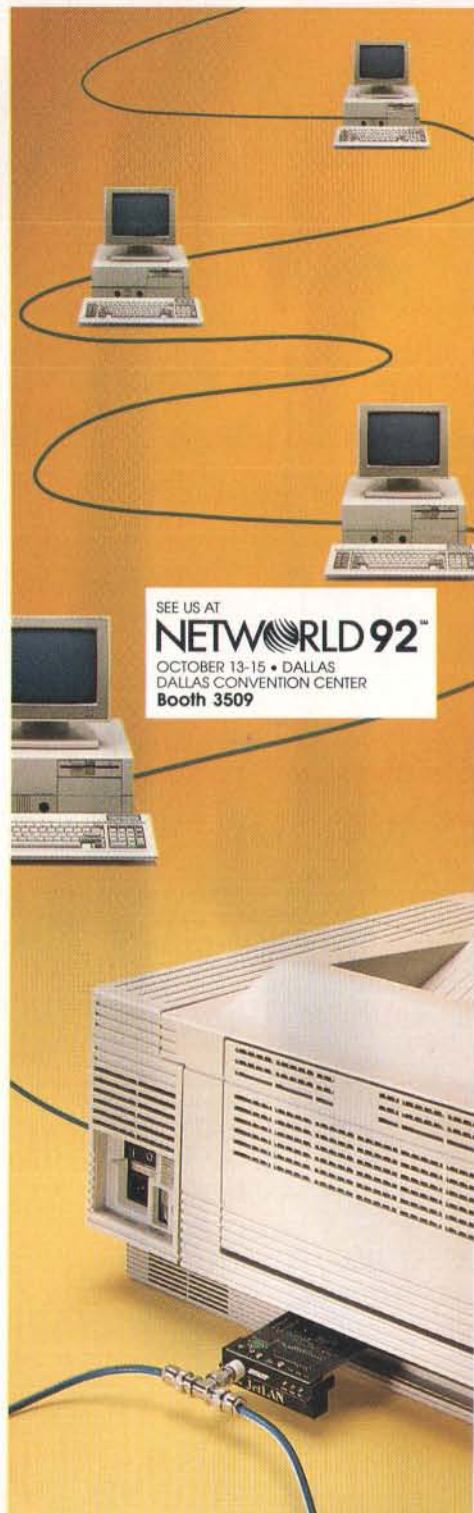
Manugistics, Inc., 2115 E. Jefferson St., Rockville, MD 20852. STATGRAPHICS is a registered trademark of Statistical Graphics Corporation. Other trademarks are the property of their respective owners.  
Evaluation © Software Digest Ratings Report, Vol. 8 No. 5 issue covering Statistics Programs. STATGRAPHICS *Plus* runs on 386, 386SX, and 486 computers with at least 4 MB of RAM and a graphics card. © 1992 Manugistics, Inc.

Circle 174 on Inquiry Card.



# Hassle-Free Printer-Sharing For Your Local Area Network

*JetLAN lets you plug your HP LaserJet printers directly into your network...anywhere!*



SEE US AT  
**NETWORLD 92™**  
OCTOBER 13-15 • DALLAS  
DALLAS CONVENTION CENTER  
Booth 3509

Here's how you can connect your HP LaserJet printers where you want them: near your network users. Without sacrificing centralized file servers for LAN maintenance and network security. Without the expense of dedicating a PC as a print server. And without software that degrades performance and hogs memory on a user's workstation.

Simply slide ASP's *JetLAN™* print server card into the 'Optional I/O' slot of your HP LaserJet II, IID, III, or IIID. Connect it to the existing twisted-pair or thin-wire cabling anywhere on your Ethernet LAN, the same way you'd add an additional PC. It's that easy! The *JetLAN* installs in less than five minutes. There's no need to shut down the network for installation, and your existing Novell software is all you need.

## JetLAN Speeds Up LAN Printing!

The *JetLAN* enhances LAN performance and improves printing speed for graphics and complex documents. And because *JetLAN* plugs directly into your printer and your existing network cabling, there are no individual PC-to-printer cables, external boxes or power supplies to clutter your office. Your system security is enhanced because there's no keyboard or monitor for access to the network.

Maybe your network users are tired of wasting time running across the building to get their laser printer output.

Or you've tried to juggle between security needs and printing convenience when you've located your file servers. And ended up compromising both.

Then take control of your network. Place your printer near the people who need it — with *JetLAN*. From ASP, your "hassle-free workgroup solutions" specialist.

To order your *JetLAN*, or for further information, fax ASP at:

**1-800-9 LAN ASP**  
Dept A2140

International 408-746-2965

**ASP**  
ASP COMPUTER PRODUCTS, INC.

160 San Gabriel Drive, Sunnyvale, CA 94086, USA • Telephone: 408-746-2965 • Facsimile: 408-746-2803  
JetLAN is a trademark of ASP Computer Products, Inc. All other brand and product names are trademarks of their respective companies.

## OPERATING-SYSTEM TRENDS

### The SDK Comes First

Intel's Windows NT goes to the beta-test stage this fall, but the Software Development Kit is shipping before that because Microsoft is trying to make it possible for developers to create 32-bit applications early. That approach is different from the old practice of shipping a new operating system and its development kit simultaneously. With the current approach, developers will have been able to test the

**D**evelopers can no longer afford to support just one hardware platform.

API and create solid applications for the new operating system much sooner.

IBM is also paying attention to the need for early information in support of a new operating system. For OS/2 2.0, it conducted an early development program that included 30,000 sites worldwide. Each site gained experience with the operating system and fed back its requirements to IBM for transition into OS/2 code.

### Future Directions

Virtually all the operating-system developers are pursuing new technologies, such as support for multimedia applications. Delivery of some of these capabilities will require changes in hardware platforms or in customers' information systems. Some of the emerging technologies will be resource-intensive, perhaps requiring changes in the operating system to efficiently handle new tasks simultaneously.

If the convergence of the worlds of computing, telecommunications, and TV occurs as expected, the huge sales volumes of the consumer markets will become a dominating influence in the directions taken in operating-system development. But until the buying power of the consumer has been tapped, the needs of the corporate customer will set the course for operating-system evolution. ■

*John Donovan is a senior analyst with WorkGroup Technologies, a market research firm in Hampton, New Hampshire. You can contact him on BIX as "jwd."*





# Charting the Bold Course: 80486-50 Mhz COMPLETE SYSTEM

ONLY \$1,899<sup>00</sup>

- Intel 80486-DX-50
  - Speed Switchable 8/50Mhz
  - AMI BIOS with setup
  - Int'l Power Supply
  - 2MB Memory on Board
  - Zero Wait State
  - 6-16 BIT-2-2 BIT Slots
  - 2 Serial 1 Parallel 1 Game
  - Turbo Reset (Led Display)
  - 1.44 3.5" Floppy Drive
  - 120 MB IDE Hard Drive
  - 14" SVGA Monitor 1024 x 768
  - 16 BIT 1MB SVGA Card
  - BTC 101 (Click Keyboard)
  - FCC Class-B Approved
  - Fully Assembled 100% Burn In
  - Shipping Carton
  - Full 1 year warranty
- 1MBx9 .....add \$34 S3 card .....add \$200  
200MB.....add \$210 Mag 15" .....add \$399  
Extra FD.....add \$56  
\*\*80486-33 Mhz same configuration \$1599.00



Includes Hard Drive  
& SVGA Monitor

## DPS

Data Products & Services Inc.

## The World's Best Notebook \$2,499<sup>00</sup>

- 85Mb hard drive (130 optional)
- 4Mb RAM (6/8/10 optional)
- 3.5" 1.44Mb floppy disk drive
- 5-Hour battery life



### 486SLC/25Mhz Notebook computer:

- 10" Paper white CCFT LCD backlit triple supertwist display 640 x 480 VGA supports 32 grey scales
- 80/81 Low-profile, soft touch keyboard
- Two serial, one parallel ports
- Super VGA/800 x 600 video external port
- External keyboard port with adapter
- Expansion port for optional docking station
- Advanced Suspend/Resume modes
- Internal removable Ni-Cad battery pack
- 90-260 VAC auto-sensing AC adapter
- FCC, UL, TUV, and CSA approved
- DOS 5.0, Windows® 3.1, Cache and Power Management Utilities included!
- Supports OS/2, XENIX, and UNIX



New from DPS

## Computer Security Keycard System

\$49<sup>95</sup>

Protect your valuable data with our new credit card type keyless entry system

- Easily installs in any PC case.
- Available for both 3.5" and 5 1/4" drive bays
- User controller password, which may be changed at any time.
- Additional security cards included at no extra cost.
- Low-cost, reliable protection

### WINDOWS SOFTWARE

MICROSOFT Windows 3.1.....	\$89.95
MICROSOFT Money .....	\$43.95
MICROSOFT Office .....	\$439.89
MICROSOFT Publisher .....	\$119.20
ADOBE TypeManager for Windows .....	\$59.07
ALDUS PageMaker .....	\$469.89
ATECH Windows Powerpack .....	\$48.52
BERKLEY After Dark for Windows .....	\$29.20
BORLAND Object Vision 2.0 .....	\$95.08
BORLAND Turbo C++ for Windows .....	\$89.90
CAERE Omipage Professional .....	\$589.42
CALERA Wordscan+ for Windows .....	\$599.42
Carbon Copy for Windows .....	\$109.37
COREL SYSTEMS Corel Draw .....	\$349.99
CROSSTALK for Windows .....	\$119.85
DELIRIA Per. Form Pro/Windows .....	\$169.13
INTUIT Quicken for Windows .....	\$34.95
LOTUS 123 for Windows .....	\$385.50
LOTUS Ami Professional/Windows .....	\$269.90
LOTUS Freelance .....	\$336.30
MICROGRAFX Designer 3.1/Windows .....	\$422.42

MICROGRAFX X-Port for Windows .....	\$422.42
MICROGRAFX Draw for Windows .....	\$422.42
MICROGRAFX Charisma .....	\$422.42
MICROSOFT C Compiler/Windows .....	\$459.12
MICROSOFT Excel for Windows .....	\$289.25
MICROSOFT Powerpoint/Windows .....	\$289.25
MICROSOFT Project for Windows .....	\$409.10
MICROSOFT Windows 3.0 Dev. Kit .....	\$292.47
MICROSOFT Word for Windows .....	\$459.12
MICROSOFT Works for Windows .....	\$119.20
MICROSOFT Windows 3.1 Upgrade .....	\$49.95
OKNA Windows Desktop .....	\$36.48
SOFTWARE PUBLISHING Superbase/Win .....	\$399.33
SYMANTEC NORTON Desktop/Windows .....	\$93.33
SYMANTEC On Target .....	\$258.17
SYMANTEC PC Anywhere IV .....	\$96.60
WORDPERFECT for Windows .....	\$263.33
WORDPERFECT for Windows Upgrade .....	\$75.95
XEROX Ventura Gold for Windows .....	\$494.62
ZSOFT Type Fonts .....	\$108.86

### SIMMS

1MBX9-70.....	\$34	4MBX9-70.....	\$129
1MBX9-60.....	\$34	4MBX36-70.....	\$585

### MICE

ZNIX Super Mouse II w/Windows .....	\$69.75
LOGITECH ScanMan PC .....	\$139.55
LOGITECH ScanMan 256 .....	\$278.45
LOGITECH Trackman Serial .....	\$69.35
MICROSOFT Mouse (Bus Version) .....	\$95.50
MICROSOFT Mouse (Serial Version) .....	\$95.50
MICROSOFT Mouse w/Windows .....	\$144.95
MICROSOFT Ball Point Mouse .....	\$118.50
MICROSOFT Serial, No Software .....	\$79.80
LOGITECH Fotoman .....	\$519.30
LOGITECH Mouseman Serial .....	\$69.35
LOGITECH Mouseman Bus .....	\$69.35
LOGITECH Mouseman Cordless .....	\$83.33

### VIDEO BOARDS

ATI VGA Wonder XL 1MB .....	\$191.20
ATI Graphics Ultra 1MB .....	\$435.40
ATI Integra..89.38 ATI Basic 16VGA.67.10 .....	\$67.10
ATI 8514 Ultra 1MB .....	\$379.77
ATI Vantage 1MB .....	\$299.24
BOCA Basic VGA .....	\$64.50
DIAMOND Speedster Stealth .....	\$298.04
PARADISE 1024i 256K/512K 5.63/207.36 .....	\$109.54/133.33
PARADISE VGA/VGA+16 .....	\$109.54/133.33
ORCHID Prodesigner IIS 512K .....	\$136.36
ORCHID Prodesigner IIS 1MB .....	\$169.45
ORCHID Farenheit 1280, 1MB .....	\$272.73
VIDEO 7 1024i 512K/256K .....	\$149.53/129.88
VIDEO 7 VRAM IIVGA 1MB/512K .....	\$274.06/256.22
VIDEO 7 VGA 16 .....	\$894.1

### IDE HARD DRIVES

42meg 25ms Conner .....	CP3000	\$199
80meg 19ms Maxtor .....	M7080A	269
107meg 15ms Seagate .....	ST3120A	309
120meg 19ms Conner .....	CP30104	359
120meg 15ms Quantum .....	LPS120A	369
130meg 16ms Seagate .....	ST3144A	379
130meg 15ms Maxtor .....	M7120A	349
174meg 17ms Conner .....	CP30174	429
210meg 15ms Seagate .....	ST1239A	599
212meg 16ms Conner .....	CP3204	559
213meg 15ms Maxtor .....	LXT213A	499
240meg 16ms Seagate .....	ST3240A	699
330meg 12ms Fujitsu .....	M2622T	1029
340meg 13ms Maxtor .....	LST340A	939
360meg 12ms Conner .....	CP3364	969
426meg 14ms Seagate .....	ST1480A	1299
510meg 12ms Conner .....	CP3504	1199
520meg 12ms Fujitsu .....	M2624T	1199
535meg 12ms Maxtor .....	LXT535A	1249
85MB 16ms Conner+MS Works Win 3.1 .....		\$510
+Dos 5.0 .....		\$510
170MB 16ms Conner+MS Works Win 3.1 .....		\$599
+Dos 5.0 .....		\$599

## MAG INNOVISION MX 15F

\$599<sup>00</sup>

- MicroXync TM Technology
  - Ultra high resolution of 1280 x 1024
  - 100 Mhz wide video bandwidth
  - Vertical refresh up to 120 Hz
  - High res. (256 steps) dual-spd. digital controls with piano keys
  - LED indicators
  - Overscan capability
  - Flat Square Technology (FST) picture tube with Invar shadow mask
  - Ergonomic design
  - Universal auto-switch power supply
- PC Magazine says, **CLEARLY THE BEST 1280\*1024 15" SVGA**

## WHY DPS?

- 10 years experience in the PC industry
- 30-day no-risk money-back guarantee
- 24-hour tech support
- 24-hour ordering
- Free on-site service on all systems
- Quick delivery
- Quality products
- Thousands of satisfied customers in the U.S. and Europe
- Friendly, knowledgeable staff
- Experts in international distribution



Guaranteed lowest International freight charges!

2-Day Express and 4-Day Economy

Federal Express 2-Day Service to all of Europe

1-5 lbs. ....	\$32
6-10 lbs. ....	39
11-15 lbs. ....	45
16-20 lbs. ....	52
21-25 lbs. ....	58
26-30 lbs. ....	64
31-35 lbs. ....	72
36-40 lbs. ....	78
41-50 lbs. ....	84

OVER 50 LBS. CALL

VOICE 303-667-8260

FAX 303-667-8245

**DPS AMERICA**

135 North Cleveland Avenue, Loveland Colorado 80537

TEL 071-378-7309

FAX 071-378-1108

**DPS/ODT (EUROPE)**

Bank Chambers, 6 Borough High St., London SE1 900





## Add-In/Add-On

ATI Graphics Ultra 1MB	460
Digichannel PC 8-port	375
Fahrenheit 1280 - 1MB	295
Hercules Gold 16/24	340/433
with 2MB	460/555
Logitech Mouseman Serial	55
Scanman 256	275
Matrox Hyper VGA	525
Mitsumi CD-ROM Kit	230
Mouse with Windows 3.1	70
Multimedia Upgrade Kit	555
Mylex GLE911	340
Mylex GXE020B	1050
NEC CD-Gallery	575
Paradise Win Accelerator	215
Proaudio Spectrum 16	215
Prodesigner II - S 1MB	185
Soundblaster Pro	195
Stealth VRAM	245
Volante AT1000/AT1200	720/1200

## CAD &amp; Graphics

Autocad Rel 11 & 12	CALL
Calcomp Digitizer/Plotter	CALL
Corel Draw	380
Design CAD 2D/3D	175/240
Drafix CAD for Windows	430
Microtek 600G/600Z	785/1350
Numonics GraphicMaster	CALL
Summasketch	CALL
ViniCAD	600
Xerox GS+ Scanner AT	1360

## Chips &amp; Memory

All Upgrades - ALR, AST, Apple, Compaq, DEC, Epson, HP, IBM, Silicon Gr, Sun, Toshiba	
387SX-20/25	105/115
387DX - 33/40	170/200
SIMM 1MB/4MB 70ns	30/125
ALL CHIPS AND SIMMS	CALL
HP Laser 2MB/4MB	120/200

Windows Accelerator S3 Hicolor 80mhz . . . \$235

P2000 Accelerator Truecolor 16M color . . . \$240

# COMPUTER QUICK

## Computers

ALR	CALL
Apple	CALL
AST	CALL
COMPAQ	CALL
Everex	CALL
IBM	CALL
NEC	CALL

## Controllers

Adaptec 1542B/1740	260/460
DPT Smartcache EISA/SCSI	575
IDE caching with 4.5MB	550
Mylex EISA/SCSI cache	660
Ultrastor IDE cache	200
Ultrastor EISA/SCSI cache	450

## Database

Clarion Pro Developer	450
Clipper 5.01	495
Database 4.5	525
DBase IV/Developers	489/839
Foxpro Single/LAN	469/565
Oracle V6	1100
Paradox 3.5 Upgrade	175
Rbase 3.1	465
Superbase 4 for Windows	460

## Disk Drives

Seagate 351AX	185
Conner/Maxtor 60MB	200
Conner/Maxtor 80MB	255
Conner/Maxtor 120MB	350
Quantum 123MB 15ms	360
Conner 170MB	370
Quantum 245MB	650
Conner/Maxtor 340	915
Conner 543MB	1165
Maxtor 675MB	1400
Maxtor 1.5/1.7GB	1750/2371
Microplus 668MB	1380
Syquest 44/80MB	CALL
Pinnacle 130S AT	1800
CD-ROM - Optical - WORM	CALL

## Modem/FAX

Modems for all portables	LOW
Modem 2400 internal	55
FAX 9600 & Modem 2400	85
Faxit for Windows	85
Hayes Ultra 96	600
Intel FAX II New Version!	395
Pocket FAX96/Modem24	150
Suprafaxmodem9696 Extl	300
USR 16.8 External	600
USR V.32/V.42Int/Ext	555/606
USR Dual 16.8 Int/Ext	765/795

## Software

Desqview 2.2/386	75/130
MS DOS 3.3/4.01/5.0	40
IBM OS/2 2.0	128
IBM OS/2 Extensions 2.0	450
XENIX/UNIX	CALL
Windows 3.1 Upgrade	55
Windows 3.1 + Mouse	75
ALL SOFTWARE - WE HAVE EVERYTHING!	

## Tape Backup

Colorado 250MB	265
HP DAT Tape Backup	
2/8GB	1500/1850
Irwin A120/A250	185/245
Irwin A250 EP	645
Software for DOS/UNIX/LAN	

**18,000 Items**  
**Price Diskette**

Shipped with order

## Networking

3COM Etherlink 2 5-pack	800
AST 5251-11 Enh Plus	515
DLink Pocket Ethernet	225
Everex Ethernet 8/16	87/135
IBM 3270 Used/New	225/410
IBM 5250 AT/MC	495
IBM Token Ring 16/4	630
Intel EtherExpress 20-pak	2230
Intel Netport	495
IRMA 3	435
LANFax for Windows	CALL
Lantastic 10MB Starter	485
Lantastic AI Node	60
Mylex EISA Ethernet	309
NE-1000 5-pack	580
NE-2000 5-pack	715
NE-2100	155
NE-3200 EISA	665
Network Lite	70
Novell Netware	CALL
Shiva Netmodem 9600	1020
SMC Ethercard Elite 6-pack	650
Elite 16 6-pack	825
Elite MC	216
Elite 32	650
Thomas Conrad 16-bit fiber card	735
8-port fiber hub	1550

USED IBM !!LOW!!

Quantity &amp; Dealer Discounts

PHONE: (415) 861-8330

Español (415) 861-8376

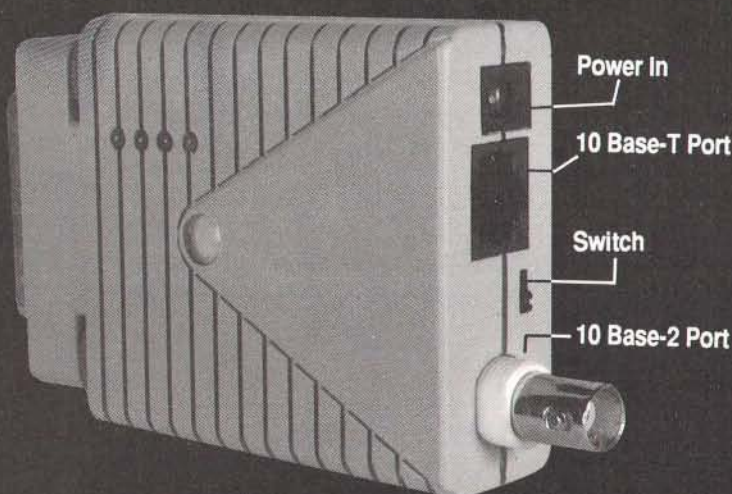
FAX: (415) 861-8380

Computer Quick, 165 - 8th Street, No. 309  
San Francisco, CA 94103, USA

Upgradable Mother Boards for IBM-AT and Compaq 286, 286e

YOUR BEST CONTACT IN NORTH AMERICA

## TP'S DUAL-PORT POCKET ETHERNET ADAPTER



Model No. TP-2000



TECHPOWER CO., LTD.

20th Fl., No. 204, Sec. 5, Mingsheng E. Rd., Taipei, Taiwan, R.O.C.

Tel: (02) 753-1930 Fax: 886-2-7531940/7153105

### DUAL PORTS COMPACT IN A SINGLE UNIT!

10 Base-T (Twisted Pair) &amp; 10 Base-2 (Thin) cabling scheme in same unit, selected by hardware switch

### SOFTWARE COMPATIBILITY:

Novell Netware, ODI driver, LAN Manager support

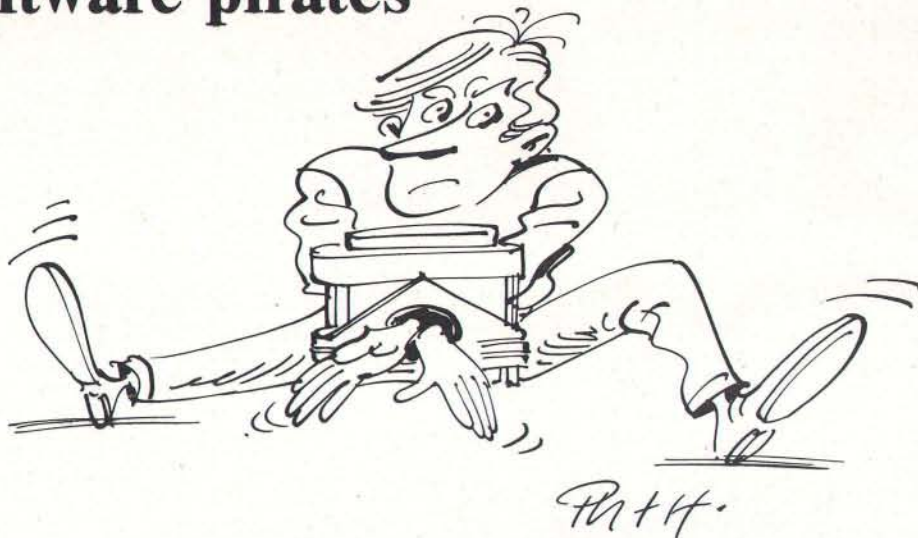
### FEATURES:

- LED indicator: Power, Traffic, BNC and UPT LED
- Compatible with IEEE 802.3 Ethernet Standard
- Connect via parallel port
- Memory Size: 32KB (not occupying system memory space)
- No Configuration Switch

All brand names are registered trademarks of their respective owners. The above information is subject to change without notice



# Hardlock E-Y-E® - tying the hands of software pirates



## The effective way to protect your software

FAST Electronic has made life a lot harder for software pirates. Hardlock E-Y-E was designed using cryptographic principles. It took the experience and know-how of Germany's number one in software protection and the leading edge technology of a US semiconductor company to create the ultimate software protection tool.

## The technology programmers have at their fingertips

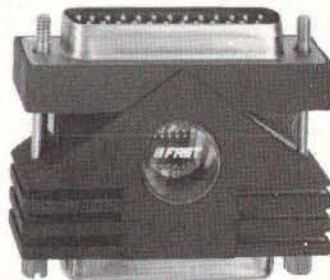
Hardlock E-Y-E is based on a custom chip and combines all the features that a programmer would expect from such a device: secure, algorithmic query routines and an optional non-volatile memory for custom configurations. With the Crypto-Programmer card from FAST you can program the algorithmic parameters and the memory within seconds. This unique card guarantees that no one else can burn Hardlock E-Y-Es with your codes. Linking Hardlock E-Y-E to your software is easy: you can either protect your .COM and .EXE files with the automatic encryption software HL-Crypt or integrate FAST's high level language routines into your source code.

## Readily acceptable to your customers

Hardlock E-Y-E allows unlimited backup copies of the master floppy. The customer gets the device together with the software and plugs it into the parallel port between the printer and the PC. Daisy-chainability, outstanding reliability and the compact high tech design guarantee that your customers will accept Hardlock E-Y-E.

## The benefits your management will appreciate

Hardlock E-Y-E can be programmed by the software house with the Crypto-Programmer card. This ensures optimum delivery schedules and stock flexibility. Revenues will go up as software piracy and multiple usage are prevented.



**Hardlock E-Y-E**  
programmable, algorithmic response  
and memory option - all in one

**Order your evaluation package today!**

**Contact B. Ajari at FAST Electronic or one of the offices below:**

### UK:

Magnifeye  
Tel: ++44-71-2218024  
Fax: ++44-71-7923449

### France:

FAST Electronic S.A. R.L.  
Tel: ++33-1-48837811  
Fax: ++33-1-48839734

### Spain/Portugal:

FAST Ibérica S.L.  
Tel: ++34-1-3613222  
Fax: ++34-1-3613219

### Italy:

Techné S.R.L.  
Tel: ++39-59-440690  
Fax: ++39-59-440720

### BeNeLux:

Crypsys Data Security  
Tel: ++31-1830-24444  
Fax: ++31-1830-22848

### Greece:

FAST Hellas AE  
Tel: ++30-1-6855 689  
Fax: ++30-1-6472 304

### USA/Far East:

Glenco Engineering Corp.  
Tel: ++1-708-8080300  
Fax: ++1-708-8080313

### Hungary:

Szki Recognita Corp.  
Tel: ++361-201-7973  
Fax: ++361-201-7607

### Yugoslavia:

G & G Electronic  
Tel: ++38-41-211624  
Fax: ++38-41-211604

**Fast Electronic GmbH**

**FAST Electronic GmbH, Kaiser-Ludwig-Platz 5, D-8000 München 2, Germany, Tel: 49/89/539800-20, Fax: 49/89/539800-40**



*For those who appreciate the art*



## *of Creating Computer Programs*

You need a "special kind" of programming environment that lets you insert your most artistic thoughts into your application.

You want an "all-in-one" programming environment — with all the tools you need — for creating high-quality feature-rich applications.

You expect a "fast and powerful" programming environment that performs with instant results — so you can create a "masterpiece" that will endure the test of time.

**You deserve the Clarion Professional Developer.**

The Clarion Professional Developer redefines the way that you develop PC application programs.

It puts you in full control of your application — opening up new, creative potential for the programming artisan.

Professional Developer is a fully-equipped development environment. With 14 dynamic utilities and the rich, comprehensive Clarion language — it gives you all the tools you need to design, develop, debug, and deliver complete, expressive applications.

Professional Developer is fast — it lets you turn your ideas into applications in much less time. A fraction of the time than the old-fashioned way of programming.

And with Professional Developer, your applications stand the test of time. You can create new or modify existing applications, as quickly and frequently as your application needs change.

Never again will too little time or limited tools restrict you from creating the kinds of applications you dream of. With Clarion Professional Developer this never happens...you're just a few seconds away from capturing the true art of application development.



**CLARION SOFTWARE**

150 East Sample Road  
Pompano Beach, Florida  
(305) 785-4555 • 1-800-354-5444



# WINDOWS NT UP CLOSE

An in-depth look at Microsoft's  
next-generation operating system

JON UDELL

**M**icrosoft's Windows NT operating system first booted in November 1989 on a hot RISC CPU and sported a next-generation interface. The CPU was Intel's 860. The interface was IBM's OS/2. Three years later, as NT nears commercial release, Microsoft's allegiance has switched to the Mips R4000 (along with uniprocessor and multiprocessor Intel 80x86 boxes) and, of course, to Windows. Some observers of the often seamy soap opera that has played out over the last few years question Microsoft's ethics. Others merely acknowledge the company's astute software engineering.

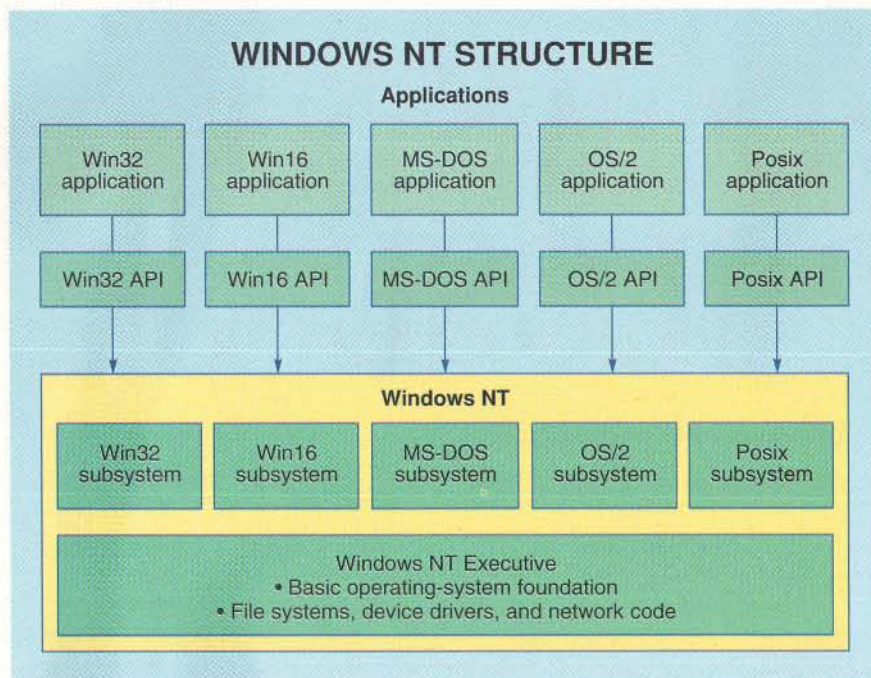
NT is, by careful design, a chameleon. Inspired by Mach, its microkernel adapts readily to any CPU and hosts various layered operating systems: 16- and 32-bit DOS, 16-bit Windows, 16-bit OS/2 (character mode and 80x86 only), Posix, and a 32-bit Windows-and-OS/2 hybrid called Win32 (see the figure). Because Win32 inherits the Windows 3.1 APIs and extension libraries, including OLE, the DDE Management Library, TrueType, and the multimedia extensions, Microsoft claims (and developers working with early versions of NT emphatically confirm) that 3.1 applications port readily to NT. When NT ships, it will run not only existing DOS and 16-bit Windows binaries but also Win32 versions of many popular Windows applications.

What's the catch? Well, don't be misled by the term *microkernel*. While the NT kernel is a petite 60 KB, the full system (as of the July beta) requires 12 MB of RAM and prefers 16 MB. Although it will probably shrink by the time it ships, NT's resource appetite will be well beyond what is standard for the corporate desktop.

*continued*







Windows NT layers a group of operating-system emulators on top of a common set of services. The NT executive manages memory, processes, and other primitive objects for the subsystems that emulate the Windows, OS/2, and Posix APIs, as well as for the applications that use those APIs.

You might think that makes NT look mainly like a platform for server applications. Clearly, it's going to cross swords with Unix, NetWare, and OS/2 in that arena. But effective enterprise computing requires capable clients as well as capable servers. Users may not need all of NT's high-end features, such as SMP (symmetric multiprocessing) and disk striping. Nonetheless, NT promises to eclipse DOS/Windows in terms of robustness, responsive multitasking, security, network awareness, and configuration management. If it delivers, many companies will conclude that these benefits more than justify the cost of hardware upgrades to support NT on the desktop.

Whether or not they have already standardized on Windows, businesses are waiting for a system that stays up reliably, can be remotely upgraded and reconfigured, and can smoothly integrate and dependably run DOS and Windows applications. Although both OS/2 2.0 and NT have the horsepower, NT offers two key advantages: It can adapt quickly to the leading-edge Intel and non-Intel hardware, and it directly supports the most popular interface—Windows.

## Basic Building Blocks

Whether it finds itself running on a uniprocessor or a multiprocessor, a CISC or a

RISC system, the NT kernel sees the same view of the underlying hardware, thanks to a substrate called the HAL (hardware abstraction layer). There's a standard HAL for 386/486 AT-bus uniprocessor systems and one for R4000 uniprocessors. Makers of systems that break new ground must write HALs to support NT on their systems. NCR has written two: one for its four-processor 3450 and one for its eight-processor 3550. Compaq has written a HAL for the dual-processor Systempro, and Wyse has one for the three-processor 7000i. The HAL makes each machine's system bus, DMA controller, interrupt controller, system timers, and memory model look the same to the kernel. It also delivers the support needed for SMP.

The HAL can't perform alchemy, however. An SMP system requires that all processors have identical instruction sets, views of physical memory, and access to devices. Further, the hardware must provide cache coherency, and the processors must be able to interrupt each other. The HAL can't create symmetry out of an asymmetric set of parts.

The kernel, riding on top of the HAL, manages scheduling and context switching, exception and interrupt handling, and multiprocessor synchronization. It is not pageable or preemptible.

The object-based architecture that is NT's

hallmark flows from the kernel, which provides two classes of primitive objects. *Dispatcher* objects (e.g., threads, events, mutex semaphores, and timers) maintain a signal state and support scheduling and synchronization activities. *Control* objects (e.g., processes, interrupts, and device queues) carry data structures used by device drivers and the NT executive, which is the interface to user-mode subsystems such as Win32.

The kernel reserves some of these objects for internal use and exports others (e.g., processes, threads, events, and semaphores) to the executive, which packages them on behalf of user-mode subsystems. When a Win32 program asks the executive to create one of these objects, the executive encapsulates the raw object it received from the kernel—for example, by assigning it a name and a security descriptor.

The kernel maintains data structures that support scheduling, such as a queue of threads that are ready to run and a matrix that describes running threads and their priorities. In an *n*-processor SMP system, the kernel guarantees that the *n* highest-priority threads will be running.

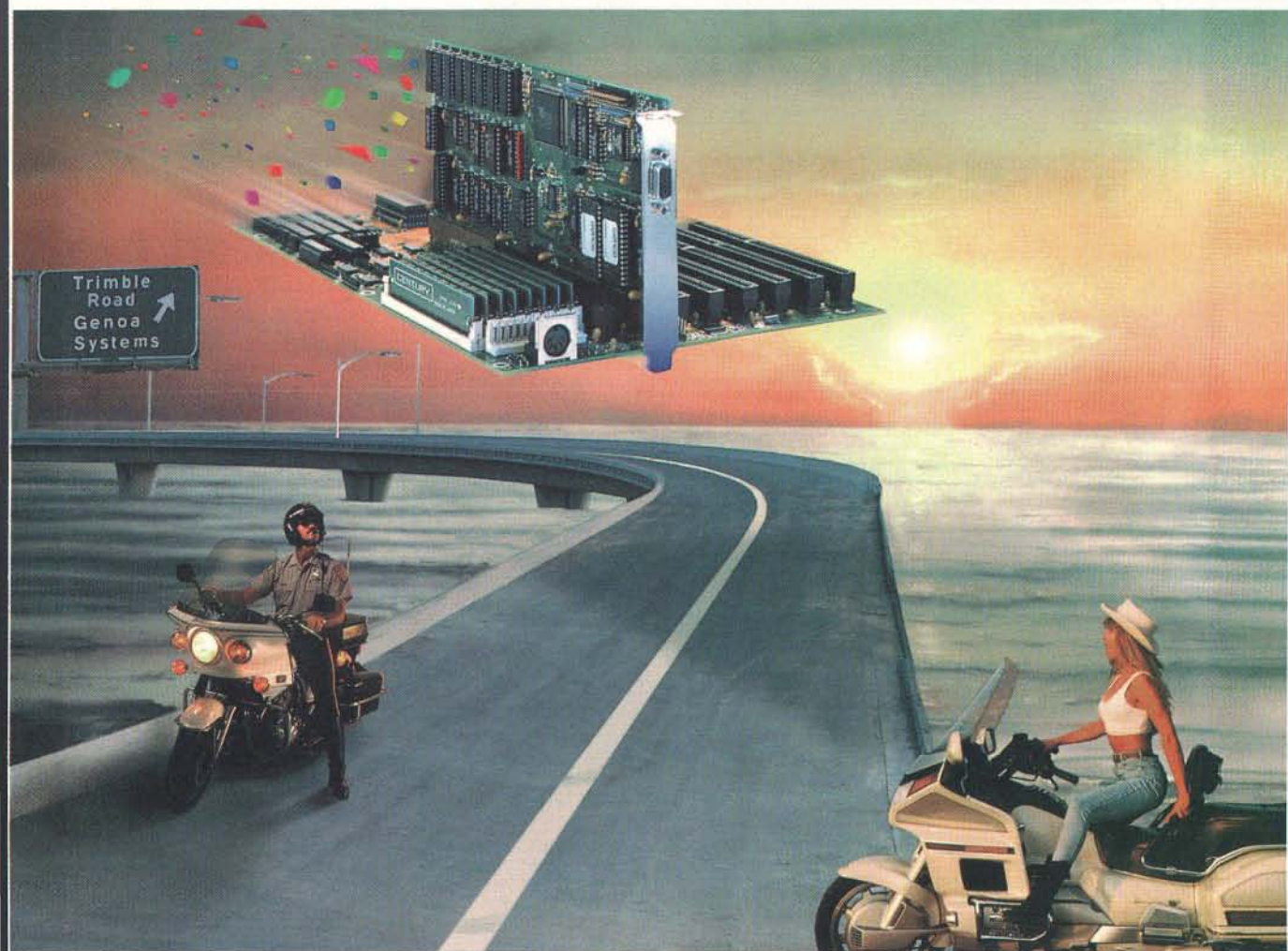
NT's scheduling is event driven. When something interesting happens to a user thread (e.g., a keyboard input message or notification that an asynchronous I/O operation has finished), its base priority receives a temporary boost and then gradually settles back to its normal state. This mechanism helps NT accommodate the unpredictable demands placed on it by users and devices. During quiet times, the kernel creates artificial events to keep things perking along. When it preempts a thread to run one with a higher priority, the kernel can assign the ready thread to any available processor. It favors the CPU on which the thread last ran, though, in case that CPU's secondary cache contains data still valid for the thread.

The executive dishes up a stew of basic services common to all the operating-system emulations layered on top of it. These include security, memory management, I/O, file systems, and IPC (interprocess communications). Like the kernel, the executive runs with supervisory privilege. Unlike the kernel, it is multithreaded and preemptible. NT achieves substantial parallelism on SMP machines even when it's executing single-threaded applications, because the work of supporting those applications is spread evenly across all available processors.

The HAL, the kernel, and the executive run in supervisor mode. The operating-system emulation subsystems, however, run in user mode. Each of these *environment servers* (e.g., Win32, OS/2, and Posix)



# The TurboBahn Series Has Arrived!



## 16 Million Color Local Bus Solution From Genoa.

**It's New, It's Landed, It's Here...  
The TurboBahn Series from Genoa.  
(ColorBahn MultimediaVGA +  
TurboExpress motherboard).**

Genoa Systems is proud to announce the arrival of the first local bus line of PC products. Total solutions for your PC that include the "TurboExpress," a 486 50MHz local bus motherboard and "ColorBahn" a 24-bit true color local bus video graphics adapter that can display up to 16 Million colors. This Super VGA sub-system provides the fastest low-cost true color alternatives for Windows 3.1,<sup>™</sup> AutoDesk AutoShade,<sup>®</sup> 3D-Studio,<sup>®</sup> and more.

### The ColorBahn MultimediaVGA features:

- ▲ FlickerFree<sup>™</sup> 70Hz or 72Hz vertical refresh rate
- ▲ Safescan<sup>™</sup>-100% use of screen on overscanning monitors
- ▲ VESA, IBM VGA, EGA, CGA, MDA and Hercules compatible
- ▲ 640 x 480 resolution up to 16 million colors
- ▲ 800 x 600 resolution up to 64K colors
- ▲ 1024 x 768 resolution up to 256 colors
- ▲ 2 Year Warranty

### The TurboExpress motherboard features:

- ▲ 486 motherboard with Local Bus
- ▲ Supports 486 (DX/SX) up to 50MHz and 256KB cache
- ▲ Supports 486 (DX2) CPU up to 66MHz
- ▲ Windows driver optimized to local BUS interface
- ▲ Performance increase up to 400% for DOS\*
- ▲ DOS, OS/2 and UNIX support
- ▲ 2 Year Warranty

**COMDEX/Fall '92**

SEE US AT BOOTH 8403  
SANDS CONVENTION HALL



**Genoa**  
SYSTEMS CORPORATION  
*The Ultimate Graphics Solution*

**U.S. & CANADA DISTRIBUTORS** ♦ **ARIZONA:** NAGA Systems Tel. 1-800 964-3939 ♦ **CALIFORNIA: (Northern)** Mini Micro Supply, Co. Inc. Tel. 1-800 275-4642 ♦ **APEX Advanced Technology, Inc.** Tel. 408/729-4090 **CALIFORNIA: (Southern)** Mini Micro Supply Co. Inc. Tel. 1-800 275-6427 ♦ **CSI** Tel. 1-800 875-2044 ♦ **FLORIDA:** Tang Inc. Tel. 305/599-9904 ♦ **GEORGIA:** Dyna Micro Tel. 404/446-6515 ♦ **ILLINOIS:** GTC Inc. Tel. 708/305-9100 ♦ **NEW JERSEY:** Panatronic Systems Tel. 201/371-9737 ♦ **NEW YORK:** Triton Technology Tel. 6/488-8852 ♦ **YKE International** Tel. 718/296-0101 ♦ **N. Carolina:** Comtech Computer Tel. 919/570-9409 ♦ **OREGON:** FEI Tel. 503/620-8640 ♦ **PENNSYLVANIA:** New MMI Tel. 7/327-9575 **TEXAS:** Microland Tel. 214/484-7515 ♦ **Dyna Micro** Tel. 713/789-7989 ♦ **CANADA:** Comtex Tel. 604/273-8088 ♦ **Micro Source** Tel. 514/731-7780

\*\* Speed increase depends on application. All registered and unregistered trademarks are the property of their respective owners. Specifications are subject to change without notice.

**Circle 451 on Inquiry Card.**



**IEEE-488**

You can control any IEEE-488 (HP-IB, GP-IB, 488.2) device with our cards, cables and software for the PC/AT/386, EISA, Micro Channel and Macintosh II. You get fast hardware and software support for all the popular languages, plus a software library of time saving utilities. Instrument control has never been easier.

**FREE**  
Informative Catalog **800-234-4CEC**  
Applications help **617-273-1818**

**cec** Capital Equipment Corp.  
Burlington, MA. 01803

Micro Channel is a trademark of IBM

and also cache return values where possible to reduce the number of trips across the client/server boundary.

## Thanks for the Memory

NT preserves the Windows 3.x Local and Global memory management routines, but its flat 32-bit virtual-memory model renders the distinction between the two meaningless. Both `LocalAlloc` and `GlobalAlloc` return 32-bit values pointing into the 2-GB virtual address space that's visible to each process (the kernel reserves the other half of the 4-GB space that a 32-bit pointer can address).

There are three other ways to allocate memory. The standard C run-time routine, `malloc`, works just fine in NT because there's no need to worry about near versus far pointers. And two new mechanisms, the Heap and Virtual routines, offer additional control beyond that which the Windows 3.x API provides. Using the Heap functions, you can grab a chunk of memory and suballocate smaller chunks within it. This approach is handy for programs that deal with lots of objects smaller than the 4-KB pages that are the NT's fundamental memory management unit. It is also a way for a DLL, which normally allocates memory in the address space of its caller, to maintain its own private heap. The Virtual functions offer direct control over NT's virtual-memory mechanism.

As with OS/2 2.0, pages can be in three states: free, reserved, and committed. A process can reserve, or preallocate, a set of pages in the virtual address space and commit the physical pages to support those pages. This scheme works well for expandable data structures. NT exploits it, for example, to enable thread stacks to grow automatically. The Virtual API also enables processes to query and set the protections that govern committed pages.

NT also provides a feature that's in some versions of Unix, but not in OS/2: memory-mapped files. To use a memory-mapped file, you create a file-mapping object, which refers to a disk file, and create a memory-mapped view of the file. Why bother? The view permits random memory-oriented access to the file's data—a major programming convenience. More important, memory-mapped files are NT's primary mechanism for sharing memory among processes.

Windows 3.x programs, running in a common address space, share memory by default. NT's more robust architecture, which isolates processes from one another, requires an explicit means of sharing. Memory-mapped files offer an interesting solution to the problem. One advantage

has its own private, protected address space. A Win32 application is a client with respect to the Win32 subsystem and must rely on IPC to use its services. Win32, in turn, maintains a client/server relationship with the NT executive.

Windows 3.x packages its services into three modules: GDI (graphics), KERNEL (general support), and USER (window management). NT preserves this arrangement but splits the modules into client-side DLLs, which map into the address space of Win32 applications, and server-side DLLs, which run in their own address spaces. For example, the client-side USER module enables applications to call API functions (e.g., `CreateWindow`), but the server-side USER module implements the function. That implementation relies on executive services (e.g., memory management and security). For example, because a window is one of the objects to which NT attaches security, the `CreateWindow` call will ultimately invoke the executive's object manager and security subsystem.

The IPC mechanism that NT provides for these client/server interactions is an RPC (remote-procedure-call) protocol called an *LPC* (local interprocess call), which operates locally rather than across the network. Applications talk to their environment servers through LPC ports, and servers talk to each other and to the execu-

utive in the same way. Note that applications are tightly coupled to their supporting subsystems. Tantalizing though the prospect may be, there's no way an OS/2 or Posix application can call the Win32 API or vice versa.

Although NT is not yet a distributed operating system, its structure of communicating parts clearly points in that direction. Because first-generation NT systems won't be distributed, though, what are the benefits and costs of NT's client/server approach for stand-alone systems?

Modularity is an obvious benefit. Subsystems are literally snap-in components. If Microsoft decides to add an OS/2 Presentation Manager layer (an off-again, on-again promise), the support DLLs could, in principle, be plugged into an unmodified NT base. Performance is the obvious cost: It's expensive to switch contexts between client and server on every API call. But the kernel does provide a fast context-switching mechanism that pairs up a client thread with a server thread and enables the two to trade states (running and waiting) with minimal overhead.

Microsoft also recommends that developers rethink Windows programming in light of NT's client/server model. There are new APIs that execute GDI calls in batches, for example, and more of these batching APIs will appear in the final release. Programmers need to exploit these



over OS/2's shared-memory mechanism is that shared storage automatically persists in the form of the disk file that backs the mapped view. If you don't need or want that feature, you can create a mapping object using the special file handle `-1`. NT will point views mapped on that object directly at the system paging file.

Both the NT loader and the cache manager that supports all the NT file systems are heavy users of the memory-mapping service. That's just one example of something that seems generally true: NT is, in many respects, its own best client.

## Processes, Threads, and DLLs

As in OS/2, threads are the dispatchable agents of execution, and processes form the context (e.g., an address space, a security profile, or a set of shared objects) in which that execution occurs. NT imposes no limit (other than available memory) on the number of threads a process can spawn. Because thread execution is conceptually (or, in the case of SMP systems, actually) concurrent, programmers have to carefully synchronize the way threads access shared data. Unix and OS/2 software developers already know the drill; however, for the programmers who have grown up with DOS and Windows, it is a new discipline—and, in all probability, the biggest conceptual hurdle that NT presents.

A programmer can synchronize threads running in a process by using a *critical section*. Once a thread claims ownership of a critical section that (purely by convention) guards a shared data object, it can safely modify the data. Other threads requesting ownership must wait until the owner relinquishes its claim.

Three additional objects—mutexes (mutual exclusions), semaphores, and events—support both intraprocess and interprocess synchronization. The latter technique relies on the objects' names, which are visible across process boundaries. Each object type has its own flat namespace, distinct from the file system's namespace.

A mutex object is a shareable version of the critical section. Threads vie for ownership of a mutex and agree to modify the shared resource it guards only when they own it. A semaphore maintains not just a simple binary state (owned/not owned) but also a counter. A server application that limits the number of client connections it can accept might use a semaphore to enforce that limit. An event object alerts one or more threads that something interesting (e.g., an I/O completion) has occurred.

NT's synchronization objects are standard constructs implemented in Unix, OS/2,

and other operating systems. What's noteworthy about the NT implementation is its polymorphism. All synchronization involves waiting: A thread waits until it owns a mutex, until a semaphore's count is non-zero, or until an event occurs. The Win32 API maps all these waiting behaviors onto a single function call, which can operate on a mutex, a semaphore, or an event. Another function waits on a set of objects that collectively describe a compound condition.

These same two waiting functions work with other kinds of objects as well. When applied to a thread, for example, the result is like a `join` in Unix: Termination of the thread satisfies the wait. This polymorphism is both elegant and practical, and it flows directly from NT's object-based underpinnings.

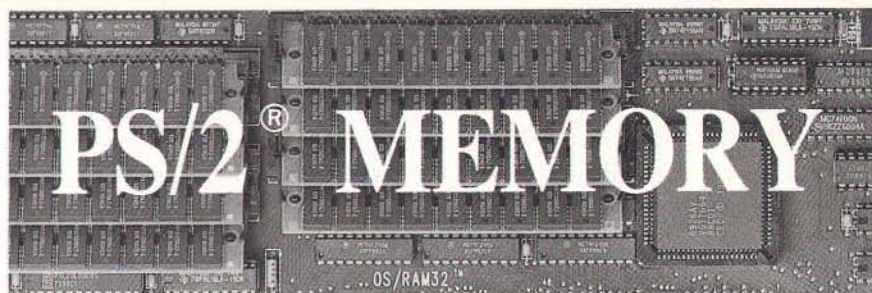
Each thread created by a Win32 application has its own message queue, in contrast to the shared message queue of OS/2 PM and Windows 3.x. OS/2 PM's input model, derived from that of Windows, requires a multithreaded graphical program to dedicate a special thread to servicing the message queue. If that queue isn't continually drained, other applications starve for input, and the whole OS/2 PM interface hangs.

NT's per-thread message queues solve this problem. If a thread fails to service its queue, only the windows that are owned

by that thread will suffer. Windows that belong to other threads respond normally, as you can prove with a simple experiment.

If you start a lengthy search in the Win32 version of File Manager, for example, you will see the familiar "I'm busy" hourglass. That is because File Manager(32) is a straightforward port of File Manager(16), which is single-threaded (ideally the Win32 version should spawn a background thread to perform the search). However, when you move the cursor outside File Manager's frame window, the cursor reverts to normal, and you are free to interact with windows owned by other applications.

In Windows 3.x, a DLL shares its automatic data among all processes that load the DLL. In NT, a DLL maintains *instance data*: one copy for each calling process. To optimize the sharing, NT bundles the instance data as a set of *copy-on-write* pages, lazily allocating a second copy of a page only when the owning process writes to the page. NT also introduces the concept of *thread local storage*, which enables processes and DLLs to stash private per-thread data. The DLL model changes slightly from that of Windows 3.x to accommodate these two flavors of private storage. NT notifies a DLL when a process or a thread attaches to it or detaches from it so that the DLL can (if necessary)



# PS/2® MEMORY

Introducing **OS/RAM32plus™** for the Micro Channel™

- ✓ Provides from 2 to 128 Mbytes of fast memory.
- ✓ Works in 16 or 32 bit mode to meet your needs.
- ✓ Provides extended and expanded memory.
- ✓ Fast software and hardware for LIM 4.0 included.
- ✓ Automatic configuration for DOS, OS/2 and UNIX.
- ✓ Easy to install. Risk free guarantee. Two year warranty.
- ✓ Add a disk cache and RAM disk using OS/RAM32plus to get maximum performance from your computer.
- ✓ Free up low memory by moving your drivers and TSR's to OS/RAM32plus. We guarantee compatibility!

Call today 617-273-1818 or 1-800-234-4CEC

**cec** Capital Equipment Corp.  
Burlington, MA. 01803

PS/2 and Micro Channel are trademarks of IBM



create or destroy instance data or thread local storage.

## File Systems and Device Drivers

NT supports three file systems: FAT (file allocation table), HPFS (High Performance File System—OS/2), and the new NTFS (NT File System). All share a common caching mechanism and can use the same fault-tolerant driver to achieve spanning or striping across multiple disks. The term *fault tolerance* is a misnomer, though, because neither of these techniques improves data reliability. You will need to upgrade from Windows NT to LAN Manager NT if you want mirroring, duplexing, or striping with parity (RAID [redundant arrays of inexpensive disks] level 5). Still, it's impressive that the base product lets you stripe data across a set of disks or join disks to create one logical volume. Even more impressive is that the fault-tolerant driver is simply a layer inserted between the file systems and the disk drivers, which know nothing about spanning or striping.

This layering of drivers pervades NT. At the device level, drivers for a class of device (e.g., a SCSI device or a network adapter) use a *port/miniport* model. The device-independent port driver implements the generic protocol for its class, and the device-dependent miniport driver enables a device to comply with the protocol. To write an NT driver for a device class that's supported by a port driver, you need only write a miniport driver. Because you write it in C, the miniport driver can move easily to any NT platform (and, Microsoft hints, to a forthcoming DOS 6 as well).

The task is simplified because the port driver handles a lot of the hard work. In particular, it helps sort out tricky thread-synchronization issues in an SMP environment where the thread that detects an interrupt and the thread that services an I/O request can run on different processors.

Will all this work as advertised? The proof will be in the pudding. If NT ships with rich support for a wide range of devices, you'll know that the layered driver model works. Note that NT already supports nearly all the printers that Windows 3.1 does, by virtue of having ported 3.1's umbrella printer driver, UNIDRV.

Device support is typically the Achilles' heel of a new operating system. If NT succeeds where OS/2 failed, Microsoft will have knocked down a major barrier to NT's commercial acceptance. By the way, NT device drivers and protocol stacks will load and unload at run time—a feature that NetWare 3.x supports but that OS/2 and most Unixes do not. Drivers that can be loaded at run time are convenient for

users and critical for servers that must run continuously and reconfigure on the fly.

## Yet Another File System: NTFS

Those of us who remember the fanfare that accompanied the introduction of HPFS may wonder why Microsoft has chosen to build yet another file system. NTFS and HPFS are close cousins in many ways. Both support long (255-character) filenames, use extent-based allocation and b-trees, and store attribute data.

But NTFS adds key strategic features—most notably recoverability. It logs all op-

### Key features

- Portability
- Symmetric multiprocessing
- C2 security
- 32-bit Windows support
- Peer networking
- DCE-compliant RPC
- OS/2 and Posix support

### Future enhancements

- B-level security
- OLE 2.0
- PM subsystem

### Drawbacks

- Current command-line scripting
- No integral 3-D graphics API

erations that affect the structure of a volume (i.e., creating, destroying, or extending files or directories) and treats them as atomic transactions against a database called the *master file table*. The log file is circular, and NTFS checkpoints it periodically to bound the worst-case recovery time. In the event of a crash, it replays the log to restore the file and directory structures existing at the instant of the crash and rolls back any transactions that were incomplete at the time. Because it journals changes, NTFS can recover a volume in seconds, as opposed to minutes for an HPFS *chkdsk* or even longer for a Unix *fsck*. Note that NTFS doesn't guard user data, and (initially) there will not be any APIs that applications can use to leverage NTFS's transaction tracking for their own purposes.

NTFS uses 64-bit addressing, so volumes and even individual files can grow to a healthy 17 billion GB (versus 2 GB for HPFS). It stores filenames on disk in Unicode, the 16-bit international standard that NT applies to all its internal character data.

Finally, NTFS is the only file system that NT can make secure. The mechanism NTFS uses to attach security descriptors to its files and directories is a generalization

of the extended attributes of HPFS. An HPFS file can hold up to 64 KB of extra data configured as a set of name-value pairs read and written by a special API. An NTFS file can contain multiple independent I/O streams, or data attributes. Standard file APIs operate on these streams using the syntax `FILENAME:STREAM-NAME`. Each stream has its own size and locks, although sharing occurs on a file-by-file basis.

File-system security is just the first application of NTFS attributes. They'll also prove useful for implementing foreign file systems on NT. Macintosh resource forks, for example, should fit neatly into NTFS. VMS-style file versioning would be another good use for these attributes. In the long run (1994 and beyond), a variant of NTFS will handle the storage requirements of the distributed, object-oriented, next-generation Windows that Microsoft refers to as *Cairo*.

## Spy vs. Spy

When NT ships, it will be C2-certifiable. Wheels turn slowly at the National Computer Security Center, so certification may lag behind product release. A C2-secure system provides *discretionary access control*: The owner of an object dictates how other users may access it. More stringent B-level security—a future goal for NT—would require *mandatory access control*, which means that objects must carry sensitivity labels that govern access according to a systemwide policy.

The NT object model supports a uniform implementation of security and auditing across a broad swath of object types (e.g., files, processes, threads, semaphores, windows, and menus) and DDE, named pipe, and RPC transactions. When an application creates or opens a reference to a securable object, NT verifies that the object's security descriptor grants the application's user access. If the check succeeds, NT caches the resulting granted-access mask for the rest of the user's session.

A key feature of NT security is that applications can extend it to user-defined objects. For example, a database server might create its own security descriptors and attach them to its tables. In addition to normal kinds of read/write security, the server could secure database-specific operations, such as scrolling within a result set or performing a join. It would be the server's responsibility to define the meaning of special rights and perform access checks. But the checks would occur in a standard context, using systemwide user/group accounts and audit logs. The extensible security model should prove useful to implementers of foreign file systems (e.g.,



# THIS IS WHAT A MASSACRE LOOKS LIKE IN THE WORLD OF APPLICATION DEVELOPMENT.

## DATAPRO DBMS USER SURVEY

	PROGRESS SOFTWARE	SYBASE	INFORMIX	INGRES	FOCUS	ORACLE
<b>ATTRIBUTES</b>						
Reliability	9.3	8.7	8.9	8.1	7.7	8.8
Ease of Use	9.1	8.2	8.2	7.9	7.9	7.4
Ease of Install/Upgrade	8.9	8.0	8.8	7.1	8.1	7.6
Price/Perform Return	9.1	8.3	8.5	7.5	8.1	7.1
<b>FUNCTIONALITY</b>						
Flexibility	9.1	8.8	8.6	9.0	8.4	8.6
Interface Capabilities	8.9	8.9	8.4	8.7	8.7	8.0
Comprehensiveness	9.1	8.8	8.8	8.3	8.7	8.7
User Friendliness	8.9	7.7	8.3	7.9	7.5	7.3
OS Compatibility	9.6	8.4	8.9	9.1	8.8	9.0
<b>PRODUCT SUPPORT</b>						
Documentation	9.0	8.2	8.6	5.7	6.2	7.3
Vendor Training	8.7	7.9	8.0	7.2	7.6	8.0
Problem Response Time	8.8	7.5	7.2	6.1	6.4	6.7
Quality of Vendor Support	9.0	7.8	7.5	6.4	6.9	7.0
Frequency of Releases	8.5	7.5	6.7	7.2	7.7	7.2
Response to User Request	8.8	7.5	7.8	7.0	7.0	7.3
<b>Overall Satisfaction</b>	<b>9.3</b>	8.7	8.5	8.3	8.0	7.9

Compiled from the 1991 Datapro Reports on Software/Computer System Series/Software, available for each product listed (Sybase from 1992). The results are those of actual users of the products as surveyed by Datapro.

## VARBUSINESS DBMS REPORT CARD

	PROGRESS SOFTWARE	INFORMIX	ORACLE	ASHTON- TATE	INGRES
<b>PRODUCT FEATURES</b>					
Ease of use	9.02	7.07	6.00	6.19	5.90
Memory requirement	7.37	6.16	4.25	6.19	5.22
Ease of programming	9.03	7.09	6.06	6.20	5.90
Ability to manipulate data	9.19	7.41	7.44	6.81	5.67
Sorting capabilities	9.02	7.44	7.69	6.65	5.78
Provision for software security	8.56	6.93	7.28	5.07	5.78
Report writing capabilities	8.39	6.72	6.59	5.71	4.11
Ease of use of interface	8.51	7.05	6.15	6.10	6.10
Software integration capabilities	8.34	7.26	7.24	6.27	6.10
Ease of data retrieval	9.08	7.68	7.66	6.61	6.11
Satisfaction with product profitability	8.26	7.04	6.22	5.58	5.13
Overall quality of product	8.94	7.37	6.69	6.32	5.44
<b>Product Features Average</b>	<b>8.64</b>	7.10	6.61	6.14	5.60
<b>SUPPORT FEATURES</b>					
Provision for customer support	7.74	5.98	5.76	5.77	5.50
Charges for training time	8.88	4.49	4.59	5.64	4.56
Provision for technical support	7.81	5.76	5.72	5.87	5.22
Provision for marketing support	6.89	5.88	6.09	6.13	3.80
Documentation & product information	8.74	6.73	6.56	6.45	5.56
Frequency of updates & revisions	8.35	5.88	6.34	5.57	5.00
<b>Support Features Average</b>	<b>7.73</b>	5.79	5.84	5.90	4.94
<b>Overall Average</b>	<b>8.34</b>	6.66	6.35	6.06	5.38

© 1991 VARBUSINESS Software Report Card reprinted with permission.

Rated on everything from performance and reliability to service and support, PROGRESS trounces all of its competitors in the 1991 Datapro user surveys and the 1991 VARBUSINESS Software Report Card.

Topping the Datapro surveys for the fourth year in a row, users give PROGRESS a rating of 9.3 for overall satisfaction. The highest mark ever awarded. Against all comers, PROGRESS is unsurpassed in all 15 categories (okay, we tie once). With a 9.0 or higher in eight categories.

**PROGRESS  
SOFTWARE**

Also, PROGRESS becomes the first product ever to capture all 18 categories of the VARBUSINESS Report Card. Racking up 9's in five categories, where no one else even gets an 8. Anywhere. So, if you're considering a 4GL/RDBMS for building and implementing high performance applications that are fully portable across major platforms, isn't it time you rated PROGRESS? For more complete information, or for our fully functional Test Drive, simply call 800-4 PROGRESS.

PROGRESS applications are fully portable across the broadest spectrum of hardware platforms, operating systems, network protocols and user interfaces. So many, in fact, that we had to list them here in small type: AIX<sup>TM</sup>, CTOS, HP/UX<sup>TM</sup>, NOVELL NLN, OSF/1<sup>®</sup>, OS/3<sup>®</sup>, OS/400<sup>®</sup>, UNIX<sup>®</sup>, ULTRIX<sup>TM</sup>, VMS<sup>TM</sup>, XENIX<sup>®</sup>, MICROSOFT<sup>®</sup> WINDOWS<sup>TM</sup>, X WINDOWS<sup>TM</sup>, DECnet<sup>TM</sup>, LAN MANAGER<sup>TM</sup>, NetBIOS<sup>TM</sup>, NOVELL<sup>®</sup> SPX/TP, TCP/IP and SNA APPC LU 6.2. Also, PROGRESS lets you process information in other databases, including AS/400, C-ISAM<sup>TM</sup>, CT-ISAM<sup>TM</sup>, ORACLE, Rdb, and RMS.

BYTADV 05



NFS (Network File System) and Macintosh).

To simplify the use of security in client/server applications, NT introduces the notion of *impersonation*. If client and server talk through an RPC connection, the server can temporarily assume the identity of the client so that it can evaluate a request for access relative to that client's rights. Then the server reverts to its own identity. NT's usual polymorphism fails here, so there is a pair of *Impersonate/RevertToSelf*

routines for each flavor of IPC: named pipes, RPC, and DDE.

## Tools of the Networking Trade

NT bundles the client and server capabilities of a LAN Manager peer server running on OS/2. An NT server can share files and printers with NT, LAN Manager 2.x, or other SMB/NetBIOS clients. Conversely, an NT server can use remote files and printers shared by NT, LAN Manager 2.x, or other SMB/NetBIOS servers. NT also

inherits mail slots and named pipes from OS/2 LAN Manager. Mail slots are unidirectional, and named pipes are bidirectional. Because both use the file-system API, they can ride on top of the file-system redirector and operate remotely (NT's asynchronous communication APIs can operate remotely for the same reason).

Like LAN Manager 2.1, NT uses TCP/IP or NetBEUI transports interchangeably, includes Unix tools (e.g., *ping* and *telnet*) and the standard MS-Net commands, and provides a Berkeley-style sockets library. Extended to support asynchronous I/O and the Windows programming model, the sockets implementation embodies the Windows Sockets specification recently completed by Sun Microsystems, FTP Software, and other TCP/IP vendors. LAN Manager 2.1 features available only in the NT version of LAN Manager will include domain (multiserver) administration, true fault tolerance, Mac services, and remote access.

NT also includes an RPC toolkit that conforms to the RPC protocol of OSF's (Open Software Foundation's) DCE (Distributed Computing Environment). NT-based RPC clients will interoperate with DCE-compliant Unix-based RPC servers and vice versa. Client-side versions of the toolkit will also be available for DOS and Windows. There's one nifty extension to the DCE model: On NT, an RPC server will automatically spin off a thread for each caller.

The toolkit supports various transports: named pipes, NetBIOS, TCP/IP, and NT's own internal LPC. The LPC option means developers can structure their stand-alone programs as collections of communicating parts and switch to a network transport to run the programs in distributed mode.

Although NT developers will face a bewildering array of network transports and IPC mechanisms, RPC is clearly the strategic choice. To drive the point home, Microsoft has used RPCs to enable many of NT's utilities to operate remotely. Print Manager, for example, handles true remote printing. There's no need to install printer drivers locally, because you can execute a print job on a remote machine using its printer driver. You can point NT's performance monitor, process viewer, and event-log viewer at your own machine or at a remote machine that you have access to.

The tool that views and edits the NT registry will work the same way. The registry, introduced with Windows 3.1, expands in NT to include configuration data for all devices, users, applications, and the system itself. Its *CONFIG.SYS*, *AUTOEXEC.BAT*, and *.INI* files, as well as a

## Turn CodeView<sup>®</sup> or Turbo Debugger<sup>®</sup> into an "ICE"

### ...at a fraction of the price!

When your debugging needs go beyond what your current software can handle, you can now add the extra horsepower you need.

How? Just **PopUp Periscope!**

Periscope<sup>®</sup> Model IV's new popup software gives you easy access to its hardware *while* you use your favorite software debugger. You can capture a true system history with absolutely no slowdown. And set sophisticated real-time hardware breakpoints. You'll have an "ICE" as comfortable to use as the debugger you already know, for a lot less than you'd expect.

Be ready for any debugging crisis—CALL TOLL FREE:

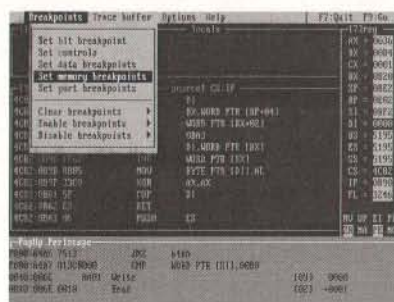
## 800/722-7006

You can *rent* Model IV for as little as \$9 a day (minimum one month).

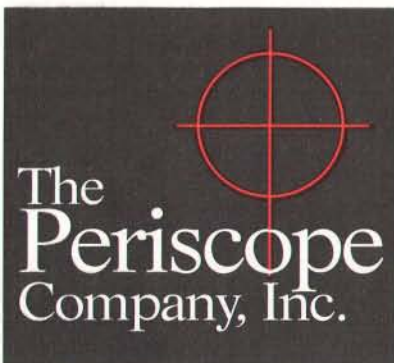
\*CodeView is a registered trademark of Microsoft Corporation. Turbo Debugger is a registered trademark of Borland International, Inc. Periscope is a registered trademark of The Periscope Company, Inc.



The PopUp Periscope software currently supports Turbo Debugger (shown above) and CodeView (shown below).



Periscope Model IV is available for systems with 286, 386DX, 386SX, 486DX, and 486DX2 CPUs running up to 33 MHz.



1197 PEACHTREE ST., PLAZA LEVEL  
ATLANTA, GA 30361 • 404/875-8080  
FAX 404/872-1973



# WEIGH THE OPTIONS

Now with  
16.8 Kbps &  
Voice Capability

**ZyXEL U-1496E**  
V.32b/42b/FAX

HS AA CD OH DTR DSR CTS TXD RXD EC SQ TST

ANS DATA /  
ORG VOICE

Model	Price	Fast Renegotiation Online Fall Back/Forward	Remote Configuration	Call Back Security With Password Protection	FAX V.17 14.4 Kbps S/R	Caller ID	Distinctive Ring
Digicom 9624LE+	\$695	NO	NO	NO	NO	NO	NO
Practical 14.4 SA	\$549	YES	NO	NO	NO	NO	NO
Microcom QX/4232bis	\$899	YES	YES	NO	NO	NO	NO
Hayes Ultra 14.4	\$999	YES	NO	NO	NO	NO	NO
U.S. Robotics Courier V.32bis	\$995	YES	YES	NO	NO	NO	NO
Telebit T3000	\$949	YES	YES	YES	NO	NO	NO
Multimodem MT1432BA	\$899	YES	YES	YES	NO	NO	NO
<b>ZyXEL U-1496E</b>	<b>\$469</b>	<b>YES</b>	<b>YES</b>	<b>YES</b>	<b>YES</b>	<b>YES</b>	<b>YES</b>

**14.4Kbps-V.32bis/V.32 + V.42bis/MNP® 5, V.42/MNP® 4,3**

**ONLY!**  
**\$469**  
Also Available:  
PC Plug-In Card  
U-1496 B \$449

## The features you want in a High Speed-14.4Kbps Modem/Fax. At nearly half the Price!

ZyXEL's U-1496E offers all the standard features available in a 14.4Kbps- V.32bis+V.42bis modem/fax with DTE speeds up to 57.6Kbps. But you'll also find features you'd expect in only the "top-of-the-line" modems. So why pay more for the features you want, when you can get the best value from ZyXEL for less?

### Caller ID/Distinctive Ring

Displays the caller's phone number, time and date stamp directly on your screen, and responds to the distinctive rings for incoming fax or modem calls.

### Enhanced FAX

14.4Kbps G3 fax with automatic detection of fax or modem calls. Automatically receives, stores and/or prints faxes with our FREE ZFAX software.

### Automatic Fast Rate Renegotiation

Online automatic speed fall-back/fall-forward allows the highest throughput achievable during poor line conditions.

### Multi-Level Security

Security password protection and automatic call-back features are designed so only authorized callers can access your system.

### Nonvolatile Memory Storage

Store up to 4 user configuration profiles in NVRAM, plus up to 10 user phone numbers and their associated passwords.

### Software/System Compatible

Supports V.25bis autodial and enhanced AT Command Set, ensuring compatibility with popular communications/fax software. Available with MAC™, Windows™ and DOS fax software packages.

### Guarantees

We offer a Full 5 year Parts and Labor Warranty, a 30 day money back guarantee and full BBS technical support line.

Once you've weighed the options, you'll agree: ZyXel's U-1496E offers the best value for less than any other modem/fax in its class. So, don't hesitate. **Call Today.**

**ZyXEL USA**  
**(800) 255-4101**  
Reseller discounts available

TEL (714) 693-0808  
FAX (714) 693-0705  
BBS/Tech.Support  
(714) 693-0762

Visit us at COMDEX FALL '92 - North Hall #4644

ZyXEL USA, 4920 E. LaPalma Ave., Anaheim, CA 92807

All brand names and trademarks are the property of their respective owners.  
Comparison chart was completed in May, 1992.



Editor's Choice: ZyXEL U-1496E  
German Edition, 4/92

Circle 213 on Inquiry Card (RESELLERS: 214).



whole lot more, are rolled into one database. RPC-enabled remote access to the registry will be a huge win for folks who manage and support NT installations. Each key in the registry carries an access control list, so RPC-enabled remote access need not compromise security. Finally, Microsoft claims that the interface definition language of the RPC toolkit will be the same as that used to define object interfaces in the Cairo environment.

Novell is working on an IPX/SPX stack and NetWare client for NT, and Microsoft hopes to bundle these components. As with the NetWare connectivity feature of LAN Manager 2.1, you'll still be running dual shells. But NT will integrate NetWare (and other service providers) more smoothly. It extends the Windows 3.1 network APIs for browsing and connecting to remote resources and provides an umbrella interface called the *multiprovider router*, which unifies the presentation of native and third-party services.

## Win32 and Win32s

From the perspective of Windows 3.x, Win32 giveth and taketh away. It extends the Windows 3.x API set to support NT's

memory management, multithreading, IPC, network, and security features. It also beefs up Windows' file I/O, communications, and graphics APIs; adds powerful support for exception handling, debugging, and event logging; and provides a console API for building character-mode applications. At the same time, Win32 jettisons those parts of the Windows 3.x API specific to DOS or to 80x86 processors.

The file I/O routines plug a gaping hole in Windows 3.x and eliminate a major source of DOS dependency in Windows code. A nice feature of file I/O in NT is that all read and write operations are potentially asynchronous. Because the file-oriented functions also work with communications ports, named pipes, and mail slots—all of which can be redirected over a network—asynchronous I/O is widely applicable. New graphics routines support paths (i.e., collections of lines and curves); Bézier curves; and 2-D transforms used to rotate, reflect, or shear images.

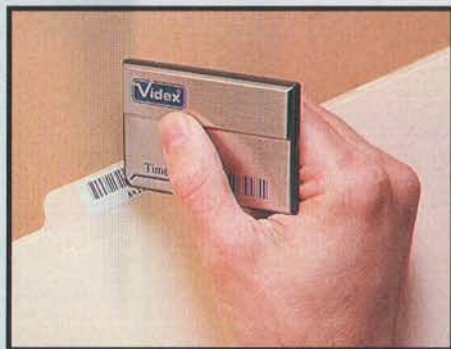
Exception handling is another of those features that's as useful to NT itself as it is to user programs. The kernel, for example, guards the execution of every thread with a handler that guarantees the same

exit path in the event of normal or abnormal termination. A Win32 application can similarly protect any block of code with a try clause followed by either an except clause (exception handler) or a finally clause (termination handler).

Although this try-except-finally syntax is specific to the 32-bit Microsoft C Compiler 7.0 in the NT Software Development Kit, the underlying support is woven into NT and can be manifested in any language environment. The mechanism is a powerful tool for controlling the complexity of applications and improving their reliability. If an application's exception handlers exploit NT's event logger, the information fed into the logs will simplify remote product support.

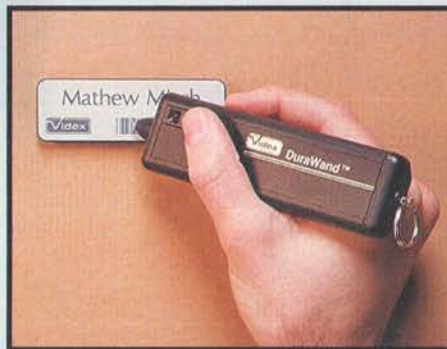
To help bolster the market for NT, Microsoft plans to support a restricted set of NT applications on Windows 3.1 by way of a Windows extender called *Win32s*. If you write an NT program that calls only standard Windows 3.x APIs, you'll have written a Win32s program. The NT binary code (if compiled for 80x86) will run under Windows 3.1 using the VxD and DLL support of Win32s. Conversely, a Win32s program developed on DOS/

## Three Good Reasons for Choosing Videx Bar Code Readers:



### Portable

Proven performers in any environment—from the office to the outdoors—Videx's family of bar code readers leads the industry as the most portable, durable, programmable data collectors. Make your job easy. Keep track of time, attendance, assets, inventory, work-in-process, shipping and receiving with a bar code reader from Videx®.



### Durable



### Programmable

demanding environments. All at prices that make them the obvious choice.

TimeWand I	\$248
DuraWand	\$495
TimeWand II	\$698

TimeWand® I, DuraWand™, and TimeWand II are designed for today's world of diverse applications and

For a free information kit, call Videx today at 503-758-0521.



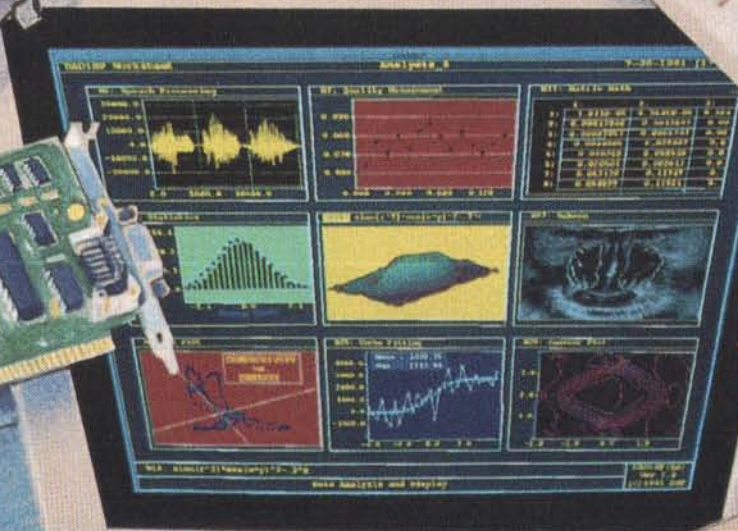
See us at Comdex Fall, Oct. 21-25, Las Vegas, BOOTH #2974, and at Scan-Tech, Nov. 5-7, Anaheim, CA, BOOTH #124

Videx, Inc., 1105 NE Circle Blvd., Corvallis, OR 97330-4285 • 503-758-0521 • FAX 503-752-5285

Videx and TimeWand are registered trademarks and DuraWand is a trademark of Videx, Inc. Circle 187 on Inquiry Card



# If you work with DATA...



## DADiSP is for you!

*The Standard Worldwide — adopted by thousands of scientists and engineers for data analysis and graphics.*

If you collect data, reduce it, analyze it, transform it, edit it, and plot it, then DADiSP will increase your productivity. DADiSP's point-and-click menus make the complete process, from input to output, easier than you ever thought possible.

Choose from hundreds of powerful functions for data reduction and editing, series and scalar math, matrix math, table manipulation, statistics, peak analysis, FFTs and convolutions, digital filtering, image manipulation and display as XY plots, contours, 3-D/4-D graphics, and shaded surfaces. And DADiSP's unique interactive spreadsheet environment helps you create your own programs and templates, *without any programming*, with macros and command files for custom work.

DADiSP is currently in use in engineering, laboratory data collection, matrix processing, manufacturing, science, signal processing, chemical and mechanical applications in automotive, aerospace, defense, medical, and other industries.

**CALL 1-800-777-5151**

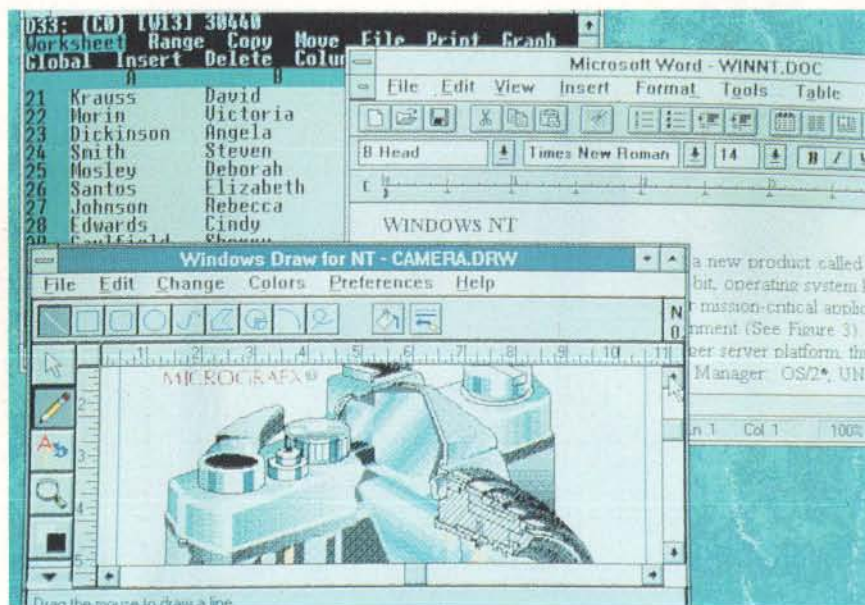
for your free DADiSP Trial Kit. DADiSP is available for SUN, HP, IBM, NeXT, DEC, Concurrent, and Silicon Graphics workstations, and of course, IBMPC compatibles.



One Kendall Square  
Cambridge, MA 02139  
617-577-1133  
FAX: 617-577-8211

**Australia**-Interworld Electronics, (03) 563-7066; **Belgium**-Electronique-Mesures, (02) 384-7309; **Denmark**-Engberg, (042) 25-1777; **Finland**-Mespek OY, (9) 0-351-1800; **France**-SM2i, (01) 34-89-78-78; **Germany**-Dataman (0711) 773131; Ingenieurbüro Köhler, (069) 9765-000; Wilke (0241) 154071; **Hungary**-Selectrade Computer, (01) 163-2905; **India**-Dynalog Microsystems, (022) 517-0514; **Israel**-Racom, (03) 491922; **Italy**-BPS Computers, (02) 612-90221; **Japan**-Astrodesign, (044) 751-1011; **Korea**-Echo Microsystems, (02) 704-5378; **Netherlands**-Computer Engineering Roosendaal, (01650) 57-417; Peekel Instruments (010) 4152722; **New Zealand**-GTS Engineering, (09) 3092-464; **Spain**-Novatronic, (04) 452-0811; **Sweden**-SYSTEC, (013) 11-01-40; **Switzerland**-Urech & Harr, (061) 61-13-25; **Taiwan**-Advantech, (02) 351-2117; **U.K.**-Adept Scientific, (0462) 480055





*Technical strengths aside, a big NT selling point is its familiar Windows GUI and its ability to run Windows 3.x applications. Companies moving to NT will not have to immediately reinvest in software and training if they've already standardized on Windows.*

Windows is an 80x86 NT binary code.

Due this fall, Win32s enables developers to begin targeting NT while preserving Windows 3.x compatibility. Although the NT 32-bit flat-memory model is available to Win32s applications, the 16-bit limitations of the underlying Windows 3.x engine (e.g., 32-KB edit controls) still apply. Moreover, Win32s applications won't interoperate with 16-bit DLLs, and vice versa, a restriction that does not apply to Windows extenders available from Watcom and Rational.

Even though Microsoft has said that Win32s will stretch the Windows 3.x API to include Win32 enhancements not specifically ruled out by the limitations of DOS and Windows, details remain cloudy. Microsoft does continue to insist that a forthcoming multithreaded MS-DOS 6 will support a full-featured Win32, constituting a true "NT Lite" for low-end hardware.

In the short run, developers will have to choose whether to target NT, DOS/Windows, or both. Because Win32s will accept the full Win32 API (returning errors for unsupported calls), it's possible—although inconvenient—to build split-personality programs that exploit advanced Win32 functions on NT but can live without them on DOS.

## Running DOS and 16-bit Windows Software

DOS and 16-bit Windows programs run on 80x86 and R4000 versions of NT (see

the screen). Both platforms use the same DOS emulation layer made from the DOS 5 source code (minus its file system, which isn't needed). That layer talks to an IEU (instruction execution unit). On 80x86 hardware, the IEU takes the form of a virtual 8086-mode monitor that traps I/O and sensitive instructions. On the R4000, the IEU is a version of Insignia Solutions' Soft-PC, an 286 emulator. The IEU simulates hardware and software interrupts, manipulates registers, and dispatches the VDDs (virtual device drivers) that emulate standard AT motherboard devices. The VDDs run in user space, where they can't affect NT's integrity.

The DOS emulator loads TSR programs low or high, provides XMS (Extended Memory Specification) and DPMI (DOS Protected Mode Interface) memory, presents text in a window or full-screen, and supports Clipboard cut and paste. DOS programs see the underlying NT file systems and can call the named pipe and mail slot network APIs. NT multitasks DOS sessions preemptively and performs idle detection.

One or more Win16 programs multitask cooperatively in one DOS session. Calls to the Windows API "thunk" (i.e., widen function-call parameters from 16 to 32 bits) directly through to their Win32 counterparts. This stands in contrast to the OS/2 2.0 model. Lacking a 32-bit Windows layer, OS/2 must rely on its DOS emulator to support Windows. Even on the R4000, NT can run Win16 programs handily.

A Windows application may spend 60 percent of its time executing Windows code. Therefore, while a Win16 program might spend 40 percent of its time slogging through the Insignia emulator, the balance will be spent running as fast as a Win32 program.

Because the Win16 and Win32 APIs are compatible, Clipboard, DDE, and OLE exchanges across the thunk boundary present no problem. The integration is seamless; when you run a Windows program on NT, you can't tell whether its mode is Win16 or Win32.

OS/2 2.0's support for DOS device drivers is something NT doesn't even attempt. Microsoft's justification is that allowing the DOS subsystem direct access to hardware would violate NT's security and reliability. Ceding this territory to OS/2 is a bit of a gamble. But if NT attracts sufficient native driver support, it will pay off.

## The Crystal Ball

The NT development team missed the target date for a feature-complete beta release by just three months. That release, widely distributed as of the July developers' conference, worked so well that some tool vendors are already shipping commercial products to other NT software developers—pretty impressive for a from-scratch effort amounting to over 3 million lines of C and C++. "And that doesn't include comments and white space," quips senior engineer Darryl Havens. "We only count the semicolons."

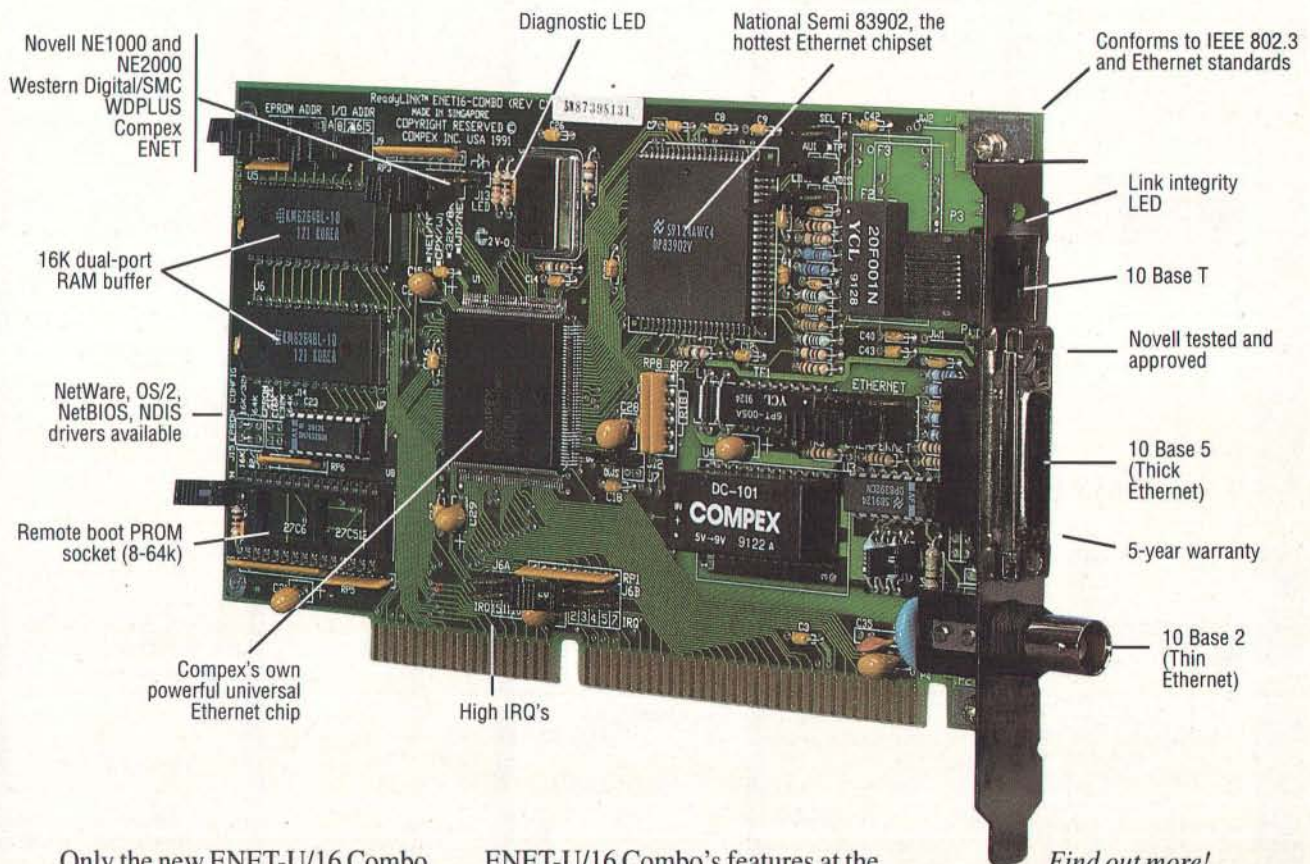
Not all the pieces have fallen into place. Although Microsoft will be licensing Silicon Graphics' 3D GL graphics library, it's unclear how that will tie into Win32. For now, Win32 inherits the Windows 3.x graphics model with its 2-D raster orientation. Win32 also inherits the underpowered DOS batch language. Object-based scripting is on the horizon for Windows in the form of OLE 2.0, but that won't appear in time for the first release of NT.

It's clear, though, that NT is built to go the distance. Workgroup-capable right out of the box and outfitted with tools geared for building distributed software, it will represent a challenge to NetWare as much as to Unix and OS/2. And in view of the relentless pace of hardware innovation, next year's multiprocessing, drive-array-equipped server will land on your desktop the year after that. When that dream machine shows up, NT will know what to do with it. ■

*Jon Udell is a BYTE senior technical editor at large. You can reach him on BIX as "judell" or on the Internet at judell@bytepb.byte.com.*



# NEW COMPLEX ENET-U/16 COMBO. OUT-CONNECTS EVERYTHING ELSE.



Only the new ENET-U/16 Combo lets you connect Novell, WD/SMC or Complex software environments. And with its multiple cabling capabilities, you can easily move workstations from one cabling system to another. If you're a distributor or dealer, you win too, because you can stock fewer cards and still meet just about any customer requirement. Best of all, you get all of

ENET-U/16 Combo's features at the cost of a coax-only adapter.

The ENET-U/16 Combo is one of Complex's hard working family of flexible, compatible Ethernet products. Thanks to our lean, agile organization, we're usually first with the newest chip sets and the latest technology. That's why you can always count on Complex to out-connect anything else.

Find out more!  
(714) 630-7302  
Fax (714) 630-6521



**Out-connecting the rest**

© 1992 Complex, Inc. Complex is a registered trademark of Complex, Inc. All other trademarks and copyrights acknowledged.



# Compu\$ave

MAIL ORDER EXPERIENCE SINCE 1985

Nat'l Orders (800) 544-8302

Int'l Orders (602) 437-8208

Info (602) 437-8298

FAX (602) 437-8988

## COMPU\$AVE SYSTEMS

486-33 ..... 2317  
486-50 ..... 2419

All Systems include: 1.2 FD,  
8MB RAM, 256K CACHE,  
120 MB HD, 101 KB, 2 Serial,  
1 Parallel, Diamond Stealth  
w/1 MB Card, 14" NI Monitor

CALL FOR CUSTOM  
CAD CONFIGURATION

## BOARDS

Adaptec 1542BK ..... 267  
Advanced Digital ..... Save  
Alloy ..... Call  
Artist WinSprint ..... Call  
Calcomp Draw Card Save  
Computone ..... Call  
Digiboard ..... Call  
Diamond Stealth ..... 245  
DPT Smart Cache ..... Call  
Hercules Grip Stat ..... Call  
Jovian Grabber ..... Call  
Metheus 1104+16 ..... 843

• Anthem/Novell  
NE-2000 ..... 152

NEC Graph Eng ..... 594  
Number Nine ..... Call  
Orchid 1280-1mb ..... 327  
Plus HC20 ..... 325  
Plus HC40 ..... 555  
STB ..... Call  
Trident ..... Save  
Vermont ..... Call  
Video 7 ..... Call

## TAPE DRIVES

Alloy ..... Irwin  
Archive ..... Maynard  
Core Int ..... Mountain  
Everex ..... Tecmar  
Iomega ..... Wangtek

Summit  
Call For Prices

## MULTIPLEXERS

Mux 900 Series-4 Chan 726  
Mux 900 Series-8 Chan 896  
Mux 1600 Series-8 Chan Call  
Mux 1600 Series-16 Chan Save  
Mux w/9.6 Intrl Modem 2138

## X-TERMINALS

Tektronix XP11 ..... 1325  
Tektronix XP13 ..... 1550  
Tektronix XP15 ..... 1925  
Tektronix XP17 ..... 2225  
Tektronix XP20 Series Call  
Wyse X5 w/KB ..... 1342

## COMPUTERS

ALR Bus. V 386/33 1559  
ALR Bus. V 486/33 1951  
ALR Bus. V 486/50 4135  
Acer 1120 UX ..... 1059  
Acer Pwr 500 486/33 2016  
Acer Mate 386/20 ..... 698  
Acer 1125E 386/25 1353  
Samsung 386SX-25 ..... 863  
Samsung PM 486/33 ..... 1690  
Samsung SM 486/33TE 3722  
Texas I TM2000/40 1267  
Texas I TM3000/20 1845  
Texas I TM3000/30 1970  
Texas I TM3000/60 2650

Texas I TM4000 ..... Call

## DIGITIZERS

Calcomp 12x12-4 ..... 299  
Calcomp 12x18 ..... 600  
Hitachi ..... Call  
Kurta XLP ..... 237  
Kurta IS/1 12x12-4 ..... 335  
Kurta IS/1 12x18-4 ..... 595  
Seiko DT-3613 ..... 274

Summa Sketch II ..... 290

Summa Sketch Pro ..... 524

Wacom SD510C ..... 541

Call FOR LARGER SIZES  
CALCOMP, SUMMA, KURTA

## SCANNERS

Alps PSX300G w/OCR 1313

Calcomp "E" Size 8622  
70436

Canon IX30F w/kit 1319

H.I. Scan CAD ..... 1998

Howtek ..... Call

Logitech ..... Call

MicroTEK 600G ..... 769

MicroTEK 600Z ..... 1328

MicroTEK 1850 Slide 1724

Panasonic RS307U ..... 850

Panasonic RS506U ..... 850

Pentax 100 ..... 587

Sharp JX320 ..... 1015

Complete PC Flatbed 955

Complete PC

Full Page /GS & OCR 657

Page Scnr /GS & OCR 477

## NETWORK SOFTWARE CALL

## PLOTTERS

AMT & Turbo ..... 1278  
Calcomp 1026m ..... 5600  
Calcomp 2024 ..... 2957  
Calcomp 2036 ..... 3855  
Calcomp 1044GT ..... 8527  
Calcomp 1070 ..... 15069  
Calcomp 8902 ..... 3029  
Calcomp DM52224 10297  
Enter SP600 ..... 580  
Enter SP-1800 ..... 2625  
Enter SP-2800 ..... 3227  
Enter SP-4820 ..... 4520  
Enter SP-4830 ..... 4584  
H.I. DMP52 ..... 2002  
H.I. DMP61 ..... 2429  
H.I. DMP161 ..... 2802  
H.I. DMP62 ..... 3219  
H.I. DMP162 ..... 3644  
H.I. DMP162R ..... 4839  
H.I. Imagemaker ..... 701  
H.P. 7440A ..... 957  
H.P. 7475A ..... 1368  
H.P. 7475B ..... 1574  
H.P. 7550B ..... 2919  
H.P. 7570A ..... 2660  
H.P. 7575A ..... 3199  
H.P. 7576A ..... 4199  
H.P. 7595C (SX+) ..... 5254  
H.P. 7596C (RX+) ..... 6652  
H.P. 7599B (MX+) ..... 7703  
Design Jet ..... 7702  
Paint Jet ..... 751  
Paint Jet XL ..... 1711  
Paint Jet XL300 ..... 2535  
Ioline 3700-8 ..... 2902  
Ioline 4000-1 ..... 3243  
Ioline 4000-8 ..... 3447  
Ioline SG4000-1 ..... 3721  
Ioline SG5400-1 ..... 8952  
Ioline 7200-1 ..... 10229  
Ioline SG5000-M ..... 4129  
Roland DXY-1100 ..... 752  
Roland DXY-1200 ..... 1027  
Roland DXY-1300 ..... 1371  
Roland CAMM-1 ..... 1975  
Roland GRX-300AG 3330  
Roland GRX-400AG 4120  
Roland DPX-2500 ..... 3433  
Roland DPX-3500 ..... 4120  
Roland DPX-4600 ..... 9997  
Sticka ..... 699  
Sketchmate ..... 465  
LTX-120 ..... 2058

## CD-ROMS

CD Tech Porta Drive 712  
Hitachi 1750S ..... 644  
NEC CDR-73M ..... 577  
NEC CDR-83M ..... 497  
NEC CDR-36 Gallery 552  
NEC CDR-73 Gallery 775  
Pioneer DRM600 ..... 906  
Sony CDU 541 w/Kit 515  
Sony CDU 7211 w/Kit Call  
Sony 7205N ..... 575

## PRESENTATION MONITORS

Mitsubishi 33" ..... 3495  
Mitsubishi 37" ..... 5375

## MONITORS/TERMINALS

Adds ..... Call

Amazing CM 8428SX 309

Amdek 738N ..... 389

Arche ..... Call

CTX Super VGA ..... 317

CTX 5468 NI ..... 350

Goldstar 1460+ ..... 309

Goldstar 1620+ ..... 750

Hitachi 20AS ..... 1839

Hitachi 2085M ..... 1420

IBM 3151-310 ..... 490

IBM 3151-510 ..... 463

Idek 5217 ..... Call

Link MC 2 w/o KB ..... 213

Link MC 5 w/o KB ..... 274

Link MC 6 w/o KB ..... 345

Magnavox CM 9039 ..... 241

Mitsubishi SD4533C ..... 438

Mitsubishi 1429C ..... 403

Mitsubishi 16L ..... 895

Mitsubishi 20L ..... 1837

Nanao T660 ..... 2650

Nanao 9070U ..... 834

Nanao 9080I ..... 1055

Nanao T560I ..... 1934

Nanao F750I ..... 2135

NEC 5D ..... 1775

NEC 2A ..... 406

NEC 3FGX ..... 699

NEC 4D-S ..... 1024

NEC 4FG ..... 843

NEC 5FG ..... 1510

NEC 6FG ..... 3110

Seiko CM 1440 ..... 461

Seiko CM 1450 ..... 556

Seiko CM 2050 ..... 1836

Sigma Designs ..... Call

Sony 1302 ..... 557

Sony 1304 ..... 620

Sony 1604S ..... 1048

Sony 1936 ..... 2353

Sony 1320 ..... 351

Televideo 955 ..... 473

Televideo 965 ..... 373

Toshiba ..... Call

Viewsonic ..... Call

Wyse 30+W/KB ..... 278

Wyse 50 W/KB ..... 365

Wyse 60 W/KB ..... 389

Wyse 150 W/KB ..... 366

Wyse 160 W/KB ..... 431

Wyse 185 W/KB ..... 355

Wyse 370 W/KB ..... 900

Wyse 670 ..... 453

## THERMAL PRINTERS

Mitsubishi S340 ..... 8633  
Mitsubishi S3600 ..... Call  
Mitsubishi G650-10 ..... 4179  
Mitsubishi G500A-10 3239  
Mitsubishi G370-10 ..... 3420  
NEC Colormate PS40 4550  
Seiko CH5504 ..... Call  
Seiko CH5514 ..... Save

## PRINTERS

Alps ..... Save  
Canon BJ10EX ..... 337  
Canon BJ330 ..... 546  
Canon LBP-8 Plus ..... Call  
Canon LBP-4 Plus ..... Save  
Citizen GSX-140 ..... 280  
Citizen 200GX ..... 159  
C. Itoh CI-400+ ..... 4032  
C. Itoh CI-800+ ..... 5495  
C. Itoh C5000 ..... 1359  
Data Products ..... Call  
Fujitsu DL3600 ..... 482  
Fujitsu DL5600 ..... 1192  
Genicom 4470XT ..... 9870  
Genicom 4490XT ..... 11913  
Genicom 1040 ..... Call  
Genicom 3840E ..... 1761  
Kyocera ..... Call  
Lexmark ..... Save  
Okidata 391+ ..... 580  
OTC 850XL ..... 1386  
Panasonic ..... Call  
QMS PS-410 ..... 1606  
QMS PS-810 ..... 2681  
QMS PS-815 ..... 3739  
QMS PS-820 ..... 3553  
QMS PS-825 ..... 3602  
QMS PS-815MR ..... 4072  
QMS PS-825MR ..... 4811  
Qume Crystal Print /52 667  
Qume Crystal Print II 1892  
Qume Express Laser 2671  
Seiko Smart Label Plus 169  
Texas I. PS17 ..... 1205  
Texas I. PS35 ..... 1481

## MODEMS

Everex ..... Call  
Multitech 224BA ..... Save  
Multitech 932BA ..... Save  
Multitech 1432BA ..... Call  
Telebit T-1000 ..... 459  
Telebit T-2500 ..... 627  
Telebit T-3000 ..... 627  
US Robotics DS/E ..... 835  
US Robotics DS/I ..... 781  
US Robotics HST/E ..... 585

Phones Are Open Mon-Fri: 7 am -5 pm Mailing Address: Compu\$ave - 4209 S. 37th Street, Dept. S'8, Phoenix, AZ 85040.  
Prices reflect U.S. currency and are subject to change without notice. We do not guarantee compatibility. DOA's are replaced or repaired. Any return requires a RMA#. 15% Restocking charge on returns. Our service dept. number is (602) 437-8298. All products carry manufacturer's warranty only. We do not honor rebates, extended guarantees or promotional programs. Mastercard and VISA are accepted. International orders add 5%. Please call or FAX before ordering.



This is what BYTE (8/1991) says about  
**CLASSNET**

## NEWS

## WHAT'S NEW INTERNATIONAL

### Computerized Classroom

**C**lassnet from Minicom Advanced Systems is a dedicated communication network that gives instructors control over all activities, by all students, in the classroom.

...The Electronic Blackboard function lets you see a student's screen, display your own screen to any or all students, display a student's screen to the entire class, and send messages in real time to any or all students. The

Interject function lets you disconnect the keyboard and darken the students' screens, giving you command over classroom activities.

By simulating the teacher's keyboard on a student's keyboard, the Assist function lets you help a student working in real time without losing visual contact with the entire class. The Communication function lets you prepare a lesson by transmitting work files

to students; send data, text, or even an exam to all students; collect students' files at the end of a lesson or exam; and connect students to external devices such as videodisk players and modems.

The Print function lets you control one printer from the teacher's unit, while the Help function tells you that a student needs help, showing you the student's station number on your screen...

### CLASSNET

- The unique communication network, giving instructors control over all activities, by all students in the classroom.

For only US\$999 for the Teacher's Control Unit and US\$245 for the Student's Unit.

To find out the full facts about CLASSNET contact us at:



**Minicom**  
Advanced Systems Ltd.

Diskin St., Villa 7, Jerusalem 92473, Israel  
Tel: 972-2-663743, Fax: 972-2-637576

## Real-Time Multitasking

for Microsoft C, Borland C, Turbo Pascal

Develop Real-Time Multitasking Applications with **RTKernel!**

**RTKernel** is a professional, high-performance real-time multitasking kernel. It runs under MS-DOS and supports Microsoft C, Borland C++, Turbo Pascal, and Stony Brook Pascal\*. **RTKernel** is a library you can link to your application. It lets you run several functions / procedures as parallel tasks. **RTKernel** offers these advanced features:

- pre-emptive, event- / interrupt-driven scheduling
- number of tasks only limited by RAM
- task-switch time of approx. 6 µsecs on a 33-MHz 486
- speed independent of the number of tasks
- use up to 64 priorities (changeable at run-time) to control your tasks
- time-slicing can be activated
- programmable timer interrupt rate
- inter-task communications using semaphores, mailboxes, and message-passing
- call DOS without re-entrance problems
- activate tasks out of interrupt handlers
- interrupt handlers for keyboard and COM ports included with source code
- supports math coprocessor and emulator
- resident multi-tasking applications (TSRs)
- keyboard, hard disk, floppy disk idle times usable by other tasks
- runs under MS-DOS 3.0 to 5.0, DR-DOS, Novell, etc., or without operating system
- ROMable
- supports CodeView and Turbo Debugger

#### New Features of Version 3.0:

- supports 36 COM ports (and NS16550)
- fast, inter-network communication using Novell's IPX services
- runs Windows or DOS Extenders as a task
- programmable interrupt priorities
- full source code available
- no run-time royalties
- free technical support by phone or fax

**RTKernel-C** (MSC 6.0/7.0, BC 1.0/2.0/3.0) ..... **DM 795** (for source code, add DM 695)  
**RTKernel-Pascal** (TP 5.0/5.5/6.0, SBP 6.0) ..... **DM 695** (for source code, add DM 595)

For international orders, add \$30 for shipping and handling. 30-day money-back guarantee available to qualified customers.  
MasterCard, Visa, check, bank transfer, COD (in Europe) accepted.

Please call or fax for our free demo disk.

**OnTime**  
MARKETING

KARSTEN PETERSEN

Karolinenstrasse 32 • D-2000 Hamburg 36 • Germany  
Phone +49 - 40 - 43 74 72 • Fax +49 - 40 - 43 51 96

## Conversion Tools for Fortran Programmers

### ■ FOR\_STRUCT™

Transforms spaghetti FORTRAN into fully structured code, with or without VAX and FORTRAN-90 extensions! GOTO and IF-GOTOs are replaced with IF-THEN-ELSE, DO WHILE and DO-ENDDOs, while retaining programming logic. Code is not duplicated, dead segments can be removed and different style options are offered. Now includes a FORTRAN test coverage analysis tool for finding hidden bugs.

### ■ FOR\_C™

Converts standard FORTRAN and many VAX extensions (e.g. structures) into ANSI C. Procedures extremely readable and maintainable C code, with excellent I/O and character translations. **FOR\_C** also utilizes a C-style preprocessor and C prototypes, and includes source to runtime libraries.

■ **Call for more information  
and combined product discounts!**

**COBALT BLUE**  
TM

**COBALT BLUE, INC.**  
875 OLD ROSWELL ROAD, SUITE D-400  
ROSWELL, GA 30076, USA  
TEL (404) 518-1116, FAX (404) 640-1182



When it came to  
Dunkin' Donuts'  
Field System,  
MIS Director  
Dave Bennett  
went  
CODE - FREE.

**SAY  
NO TO  
CODE!**

SEE US AT  
**COMDEX/Fall '92**  
SANDS EXPO CENTER  
BOOTH 3242

Byte 10.92

Dave joined the ranks of MIS professionals who have kicked code and boosted their productivity with Magic. A quantum leap beyond 4GL, Magic lets you develop applications by logically describing their functionality in a table-driven prototyping environment. This unique code-free, object-oriented methodology slashes your development and maintenance time by up to 90%!

### Say YES to Magic Productivity



**3GL, 4GL:**  
Design  
Code/Compile/Link  
Debug  
Re-Code

Programming Cycle Comparison



**Magic  
Fast, Incremental  
Development:**  
Design, Prototype,  
Test and Modify  
All-in-one

But don't let its programming speed fool you. Magic delivers superior programming power - excelling in the building of sophisticated database applications with advanced multi-user, multi-line and multi-window functionality. Transparent portability between all Magic-supported platforms, interoperability and client/server architecture make Magic the ideal strategic tool for open environment computing\*.

To find out how you can join over 100,000 code-free Magic users, contact any of the numbers listed below. Your productivity depends on it.

\* DOS, LANs, UNIX, VAX/VMS, OS/2, and CTOS/BTOS are all supported along with MS - Windows deployment.

Dunkin' Donuts is a registered trademark.

# MAGIC

Magic Software Enterprise  
**PRODUCTIVITY BEYOND 4GL**

MSE - U.S. Tel: (714) 250-1718, Fax: (714) 250-7404 • MSE - U.K. Tel: (44-81) 902-8998, Fax: (44-81) 903-1465 • MSE - International H.Q. Tel: (972-3) 751-1914, Fax: (972-3) 751-19

Australia

Tel: (3) 412-3593,

Fax: (3) 416-2985

Austria

Tel: (222) 535-9860,

Fax: (222) 535-9861

France

Tel: (1) 4204-2118,

Fax: (1) 4772-9183

Germany

Tel: (06131) 995000,

Fax: (06131) 995024

Hungary

Tel: (1) 165-3325,

Fax: (1) 165-3325

Netherlands

Tel: (10) 434-3262,

Fax: (10) 460-0805

Spain

Tel: (1) 442-1244,

Fax: (1) 441-6856

Switzerland

Tel: (22) 731-118

Fax: (22) 738-11

178IS-4 BYTE • OCTOBER 1992

Circle 386 on Inquiry Card.



# OS/2 AT THE CROSSROADS

IBM's desktop operating system  
has all the tools, but it needs some direction

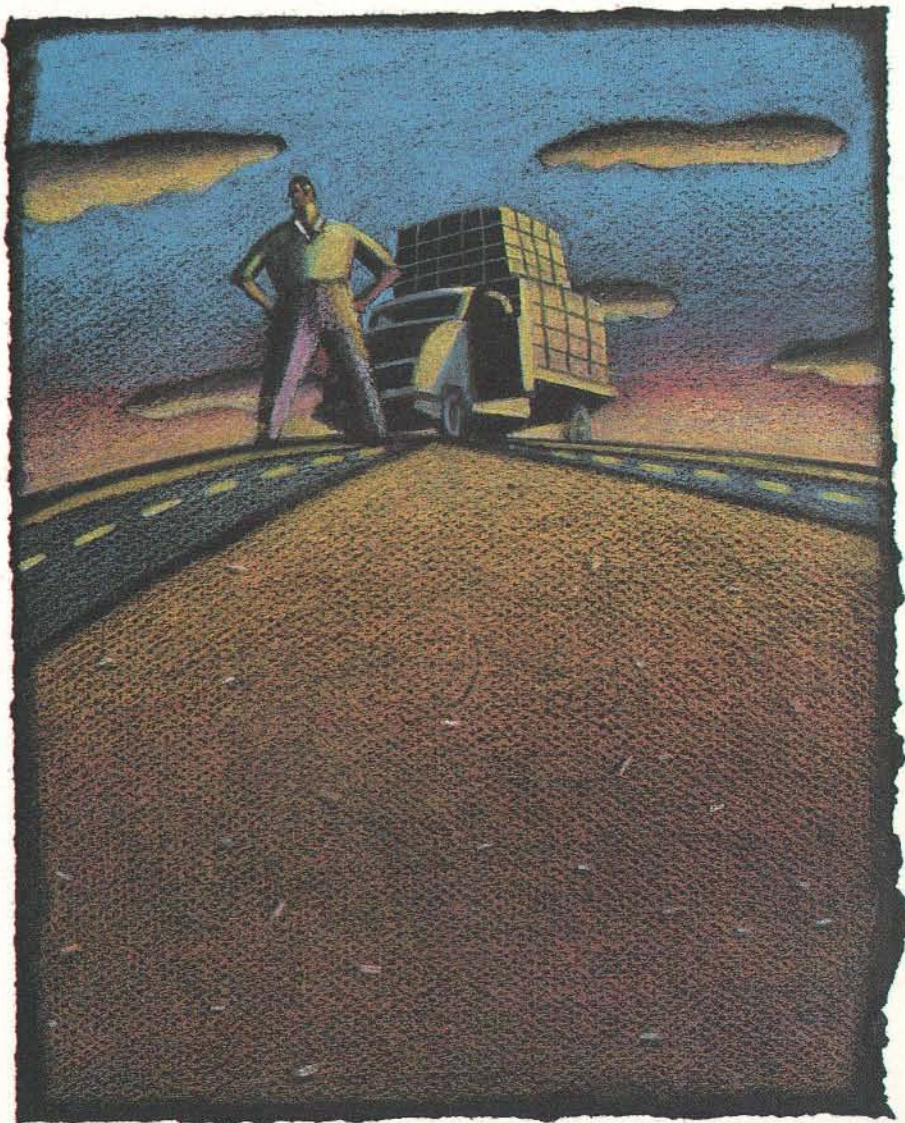
MARK MINASI

Since its introduction in 1987, OS/2 has garnered more than its share of both praise and scorn and has been the hope and the death of a few software companies. For all that, OS/2 still hasn't found its niche. But IBM believes in OS/2—should you?

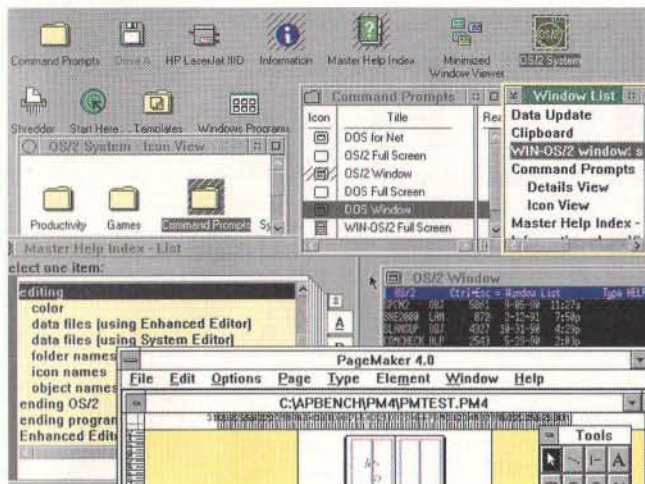
From a technical standpoint, there's a lot to be said for OS/2, and in particular OS/2 2.0. It's a 386-based protected-mode architecture that works well on basically the same computers that do a good job running Windows 3.1: 386-class machines running at 25 MHz and higher, with 8 MB or more of RAM. The OS/2 difference is its robustness.

I'm writing this article with the OS/2 System Editor, the OS/2 version of Windows Notepad. I'm also running the Windows Clock program in a window of its own. At the same time, I'm watching the computer play Chess against itself, and I'm monitoring the system with Pulse. Chess is one of the free programs that comes with OS/2, and it doesn't play a bad game at that. However, my main interest in Chess is as a CPU overloader. You can make the computer play both white and black and set the player strength level anywhere from pushover to expert. Set white and black to the expert level, and you've got a pretty busy computer.

That brings me to Pulse, another free goody that comes with OS/2. Pulse is a CPU-utilization profiler, and I mention it as an example of how OS/2's underlying framework is superior to that of Windows 3.1. There really is no way to write a CPU-utilization profiler for Windows, because it uses a cooperative multitasking structure. If you're running five Windows programs, and one program wants to hog all







*OS/2 2.0's Workplace Shell GUI is a model of consistency. Many OS/2 features, such as Print Viewer, take advantage of the Workplace Shell's object-based paradigm to deliver improved productivity.*

the CPU time, there's nothing that the other programs—or Windows itself—can do about it. With OS/2, all the programs that demand the CPU's attention are forced to wait in line. I see an occasional delay in getting my text onto the screen, but it's almost imperceptible.

## Protected, But Not Bulletproof

OS/2 makes good use of the protected modes of the 386 family, the protected mode of the 32-bit 386, and the mode of the Virtual 8086 that makes DOS multitasking possible. In general, it's impossible for one program to make another crash or to crash the operating system. It is easy for a buggy program to crash itself, but no operating system can address that problem unless the protected mode is extended to protect software from programmers.

Although robust, OS/2 is not bulletproof. It uses the protected mode to protect one program from another, but it shares memory usage among programs that utilize the GUI support provided by the GPI (Graphics Programming Interface). After a program returns from a GPI call, there's enough information left on the program's stack to allow the program (if written for evil, not good) to directly modify data structures in the GPI. This is unlikely, but it is a possibility—although an anomaly, given that operating systems seem to be evolving toward complete protection.

The fact that OS/2 isn't completely secure has its good points. At least for a while, the majority of the programs that run under OS/2 2.0 will be Windows and DOS programs, and there's something that OS/2 can do for those programs that even Microsoft's heavy hitter Windows NT can't do. Most DOS programs directly address the PC hardware either through memory addresses or I/O addresses. Protected mode means protection for the I/O

addresses, so any PC operating system that wants to exploit protection and still support DOS programs must make a tough decision: how to allow DOS programs to continue to directly address hardware.

The most common approach—and one that makes about 70 percent of the DOS programs happy—is to create a virtual PC, complete with virtual I/O addresses. The addresses are connected to programs that are drivers for hardware (e.g., a virtual keyboard, video, a disk, a serial port, and a parallel port). As long as the virtual drivers are relatively efficient, you have the best of both worlds: DOS programs think they're twiddling hardware while, in fact, the operating system retains control of it. Windows 3.1, OS/2 2.0, and NT all take this route.

But what about the nonstandard hardware that's becoming standard (e.g., fax boards, tape drives, and CD-ROM drives),

as well as the smaller but important niche markets that include 16-port RS-232 boards and data acquisition boards? IBM has learned from the compatibility problems of OS/2 1.3 and now allows DOS device drivers to virtualize in a DOS session—quite a neat answer. Windows 3.1 allows a DOS program to directly modify any hardware that's not on Windows' do-not-touch list, which is one reason why it has been easy for purveyors of niche hardware to adapt their products to Windows. But NT offers no solution for those people, making their DOS and Windows 3.1 products unable to run under NT. Is this a flaw? To some, yes; to others, it's the price that must be paid for an airtight software platform.

## The Workplace Shell

A discussion of the state of OS/2 would not be complete without a mention of the WPS (Workplace Shell). I have never liked GUIs, but I'm finding that I'm getting along pretty well with this one (see the screen).

WPS looks like it was designed by one person rather than a committee: It's got a consistent thread running through the way it operates. I've often been surprised by the kinds of things on the WPS screen that support the shell's object-based paradigm. Even things like the Print Viewer are examples of how much an object-based way of looking at things can make a user interface a productive tool.

## Market Talk

Technological issues aside, how's OS/2 doing? In a word, badly. IBM claims that it has shipped 700,000 copies since the March release. With 110 million PCs out there, that means a market share measured in tenths of a percent. Worse yet, there are relatively few people writing code for OS/2.

There is, however, a small but significant part of the computing market that is quite happy with OS/2: the COBOL crowd that wants to save a few cycles on their mainframes. I do a lot of work for companies with large-scale processing systems, written in COBOL, that have been on mainframes for years. These companies are not downsizing in the usual sense, because they are happy with their mainframes. Instead, they are doing their initial coding and testing on OS/2-based computers running Micro Focus COBOL with the Animator debugger (it's practically an industry standard). It's not a huge market, but it's a solid one—at least for now.

Earlier, I compared some of OS/2's architecture to Windows 3.1's, and 3.1 came off looking badly. Lest I be taken to task for not telling the whole story, all the good

## Key features

- Workplace Shell GUI
- Preemptive multitasking
- Multithreaded
- 32-bit virtual memory
- DLLs
- Named pipes and mail slots

## Future enhancements

- Windows 3.1 support
- 32-bit imaging model

## Drawbacks

- Lack of user/developer acceptance
- Nonbulletproof protected mode
- Inadequate device support out of the box



# Northgate® ZXP™ Systems With Unlimited 486 Upgradability And Three Cabinet Styles!

**DX2/66**  
Available  
Now!



**"We recommend the upgradable ZXP without reservation... Best Buy"**  
*PC World, August 1992*

**"The pride of the system, the ZIF socket, should stand as an example to anybody who wants to manufacture an upgradable system. The Northgate ZXP is our favorite upgradable - by a large margin!"**  
*Computer Shopper, August 1992*

## Here's Just One Power-Packed ZXP System!

- Intel 80486DX/33 MHz processor
- 4MB of RAM; expands to 32MB
- 200MB hard drive
- 1.2MB and 1.44MB floppy disk drives
- 1024 x 768 color monitor with 1 MB video card
- Space-saving desktop case
- MS-DOS® 5.0
- Microsoft® Windows™ 3.1 and mouse
- Award-winning Northgate service and support
- 30-day money back guarantee

**Only \$2499**

Lease as low as \$85.47/month\*

## Other ZXP Systems Configured As Shown:

486SX/25 .....\$2199  
Lease as low as \$81.36/month\*

486DX2/50 .....\$2799  
Lease as low as \$95.73/month\*

486DX2/66 .....\$3199  
Lease as low as \$109.41/month\*

Call for more information!

**800-345-8709**

Major corporations, volume purchasers and government agencies call National Business Accounts: 800-545-6080  
GSA # GS00K91AGS5193 PS01

Major credit cards, money orders, direct wire, and approved purchase orders accepted.



7075 Flying Cloud Drive, Eden Prairie, MN 55344

"When it has to work right"™



© Copyright Northgate Computer Systems, Inc. 1992. All rights reserved. Northgate, ZXP and the Northgate logo are registered U.S. trademarks of Northgate Computer Systems, Inc. 486SX and 80486 are U.S. trademarks of Intel. MS-DOS, Windows and Microsoft are registered U.S. trademarks of Microsoft Corporation. All other products and brand names are U.S. trademarks and registered U.S. trademarks of their respective companies. Prices and specifications subject to change without notice. Taxes shown do not include shipping, handling charges and appropriate sales taxes. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability. We support the efficient use of software. To report software copyright violations, call the Software Publishers Association (SPA) Policy Hotline at 1-800-388-PUB. All systems shipped with DataSentry™ GA Plus™ software. \*Monthly lease payments are based on a 30-month standard office market value depreciation schedule, 12-20 month leasing options available for qualified businesses.

CODE B4710



things that I said about OS/2 2.0's robustness applies to NT—and more. That is one of OS/2's big problems in market acceptance: It is caught up in a squeeze between Windows 3.1 and NT. Had IBM brought OS/2 2.0 to market in early 1990—as it could have, albeit without Windows 3.0 support—I believe that it would have been able to develop a firm foothold on the high-end desktop market. Another example of the squeeze play can be seen in my earlier discussion of protection: Windows 3.1 has less of it than OS/2 2.0 does, but NT has more of it.

## Further on down the Road

In the near future, you will see several things in OS/2. First, its GUI will get a much-needed shot in the arm from the Micrografx 32-bit engine, due out soon and perhaps available by the time you read this article. OS/2 will also support Windows 3.1 programs, something that it cannot do now.

One thing I haven't heard much about is where IBM plans to position OS/2 as a server platform. OS/2's main use as a server is under LAN Manager and its cousin, the IBM LAN Server. But Microsoft is moving toward NT as its platform for LAN

## Will OS/2 2.0 programs run under Taligent?

Manager, and IBM seems to be more firmly in Novell's camp with each passing announcement. IBM should clarify this soon.

OS/2 needs better device support. While it needs a powerful computer to run on, OS/2 also needs one that is plain. I've despaired of ever getting my Ultrastor 22CA ESDI controller to work under OS/2. In contrast, the prebeta version of NT supports many Super VGA boards, SCSI devices, and accelerators. If IBM really wants OS/2 to be a success, it must ship in the box support for the 20 most popular LAN adapters, Super VGA boards, bus mastering SCSI and ESDI controllers, CD-ROMs, and tape drives.

OS/2 also needs a clear long-term commitment from IBM. With Taligent on the horizon, why develop for OS/2? Will OS/2 2.0 programs run under Taligent, will they have to be compiled, or will there be no compatibility at all? All IBM will say is that "there will be a migration path." One developer asked me, "Does *migration path* mean that my application will go south when I try to run it on Taligent?"

In addition, OS/2 needs documentation. It ships on a couple of dozen floppies, with a few short pamphlets describing the installation process. Once you've got it up and running, there is an extensive Master Index of all the help information. It's quite good, but the installation has got to be daunting to someone accustomed to seeing manuals. In fact, that's a problem that I've heard many companies cite when considering whether or not to go to OS/2. □

*Mark Minasi writes and conducts basic and advanced seminars on Windows, OS/2 2.0, and OS/2 1.3 to 2.0 migration and is the author of the book Inside OS/2 (New Riders Publications, 1992). His firm, Mark Minasi & Co., is based in Arlington, Virginia. You can contact him on BIX as "mjminasi."*

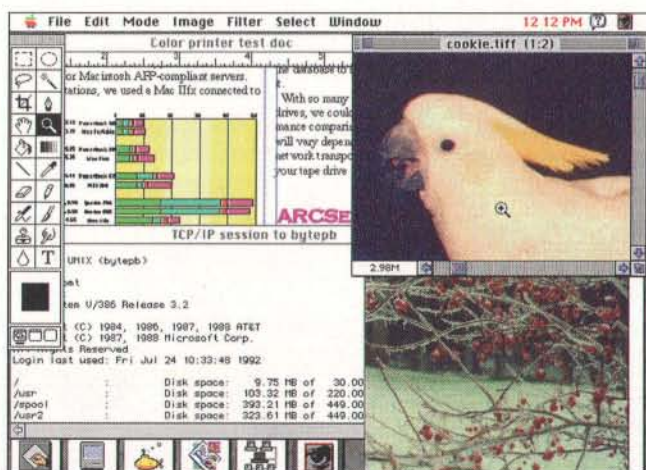
# The Future of System 7.0

Apple's Mac operating system is its road to the PowerPC

TOM THOMPSON

Apple will continue to expand the capabilities of its operating system to differentiate it from other GUI-based operating systems. New features will be oriented toward providing users with a complete but easy-to-use work solution (see the screen). Some features will be obvious modifications to the GUI itself; others will lurk behind the screen, supplying crucial facilities (e.g., color matching). Also, Apple plans to move the Mac OS to the PowerPC, the RISC processor developed by the Apple-IBM-Motorola alliance (see "The Future of Personal Computing?" February BYTE).

The Mac OS's modular design and its expandability (via software patches called *extensions*) will be used to add new features without jeopardizing compatibility with the existing software base. Earlier examples of this abound: MultiFinder added cooperative multitasking retroactively



*The Mac System 7.0 GUI is the one that all others are measured against. As a totally integrated environment, it works seamlessly with the environment while providing a high degree of ease of use.*

to all existing Macs; 32-Bit QuickDraw revamped the QuickDraw imaging engine for handling 24-bit color; and QuickTime

added time-based data manipulation required by multimedia to color Macs. All these extensions added new capabilities



# To run X on your PC, you'll have to master this extremely complex operating procedure.

"Click."

Running X on your PC couldn't be simpler. With PC-Xview for Windows, all you do is point and click. There's the X application, from across the network, in its own window on your PC. Now cut, paste, and move information between X and Microsoft Windows,<sup>TM</sup> just as you're used to doing.

Or if you work on a DOS-based PC, just add PC-Xview for DOS to access graphics-based X applications.

And when work takes you on the road, take our PC-Xremote option to access the X environment over a modem. So critical applications are always at your fingertips, no matter where you are.

With products like these and proven customer support, NCD makes accessing X applications as easy and convenient as using a PC.

So for more information about how PC-Xview will get your PCs and X to really click, simply call: 1(800) 800-9599.



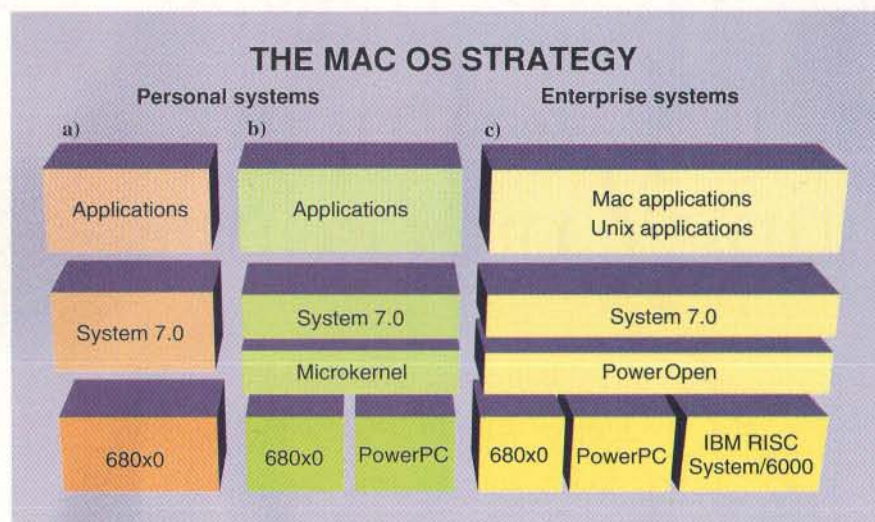
Network Computing Devices, Inc.

All registered and unregistered trademarks mentioned above are the sole property of their respective owners.

**Circle 205 on Inquiry Card.**

**NCD**  
PC-Xdivision





(a) The current Mac OS implementation. (b) In the future, a microkernel will supply hardware services using multithreaded code. On top of the kernel, System 7.0 provides operating-system services, with the microkernel communicating to either a 680x0 CISC processor or a PowerPC RISC processor. (c) The PowerOpen architecture will provide hardware services for enterprise computing, which can use Mac and Unix applications or the Taligent operating system.

without affecting the compatibility of most applications software.

System 7.0, Apple's latest operating system, consolidates many of the just-mentioned extensions (the exception is QuickTime, which arrived after System 7.0's release) while offering improvements such as a built-in file-search function, keyboard navigation, peer-to-peer file sharing, and IAC (Interapplication Communication). It provides the new base on which Apple plans to build its future operating-system enhancements. Because of this strategy, users clinging to System 6.0.x should plan to upgrade soon or be left behind.

### The Immediate Future

Apple's System 7.1, due for release this month, will fix some bugs now found in System 7.0 and offer new features. There are some significant changes as well. First, System 7.1 will address global markets by using a 2-byte character-storage scheme. This provides system-level support for languages using large character sets, such as kanji. Second, it can use either Type 1 PostScript or TrueType fonts on-screen and for printing. PostScript Level 2 printing support will be provided. Finally, this operating system will be a *reference* version: When Apple introduces a new computer, a "personality" extension will patch System 7.1's structure to recognize and use the new hardware. This eliminates the proliferation of operating-system revisions that occurred under System 6.0.x when a new Mac was introduced.

Apple will add other features and utilities incrementally through the extension mechanism to minimize compatibility problems. Announced new features include AppleScript, a control language similar to DOS batch commands or Unix shell scripts; a store-and-forward mechanism

### Key features

- Use of extensions to add features while maintaining compatibility with applications software
- Advanced color capabilities
- Interapplication Communication
- Peer-to-peer file sharing

### Future enhancements

- Ability to handle large character sets
- PostScript Level 2 printing support
- Ability to use Type 1 PostScript and TrueType fonts for both printing and on-screen display
- AppleScript control language
- Open collaboration environment

### Drawbacks

- Inconsistent cooperative multitasking

called the *OCE* (Open Collaboration Environment), which integrates mail, messaging, and document validation; and QuickDraw GX, a new imaging engine.

A brief look at QuickDraw GX is instructive because it illustrates the tightrope Apple walks in providing new features without compromising compatibility. QuickDraw GX is an object-based imaging system (i.e., it treats text, lines, polygons, and bit-mapped images as objects with specific characteristics), unlike QuickDraw's pen-oriented imaging system (where you draw a line by setting a pen's characteristics and then moving the pen to different screen coordinates). QuickDraw GX handles algorithmic fonts, and it also provides systemwide color-matching support.

QuickDraw GX does not use QuickDraw's data structures or code, so it can coexist with QuickDraw in the same computer. This enables existing applications to run and allows application designers to migrate their code to the new imaging architecture as necessary. This situation is identical to that of QuickTime, which doesn't interfere with the existing software because it bypasses QuickDraw completely.

### Kernels and RISC

Despite these improvements, System 7.0 still has fundamental design flaws. Cooperative multitasking works, but it's only as good as the worst-written application. It places the job of sharing processor time with other applications on the application designer, not on the operating system. The processor is still saddled with screen drawing and moving bytes to some peripherals. These are jobs better off-loaded to co-processors and DMA channels.

To achieve this end, Apple plans to re-vamp and consolidate hardware-specific functions into a microkernel, which will be the foundation for a preemptive time-sliced operating system, with memory protection, demand-paged memory, and semaphores for task coordination. The kernel will be multithreaded to provide DMA and asynchronous I/O. Apple will make the kernel's size and hardware requirements lightweight so that it can run on as many Mac models as possible. A series of extensive patches and new system resources will be used to implement the microkernel on existing systems. The rest of the operating system and applications will lie atop the microkernel (see the figure).

To make the migration of Mac software to a PowerPC-based Mac as painless as possible, Apple will implement a 680x0 object code emulator so it can run existing applications. Although emulation typically

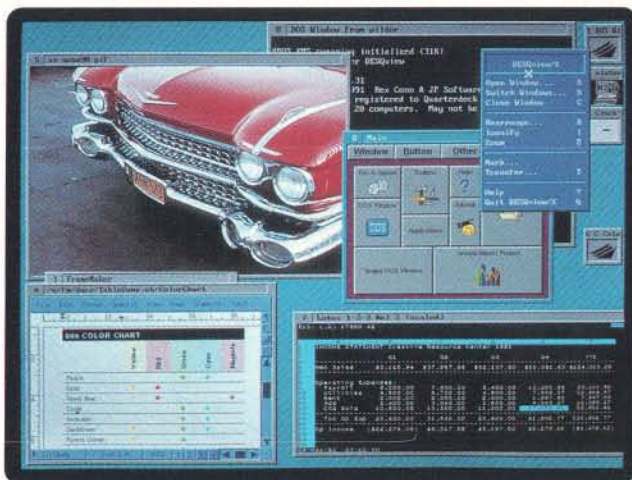


# End PC Envy

## A Window on the Network

As you can see, DOS programs run alongside Microsoft Windows programs. You've seen this all before in our DESQview, right? Yes, but now there's more. DESQview/X lets you access and control a wide variety of PCs and workstations through your own PC. This feature is called remote computing.

In the example to the right, Lotus 1-2-3 is running in its own 386SX PC. The window at the top center is a DOS window running on a remote 486 PC under DESQview/X. At the bottom left is a FrameMaker file running on a remote IBM RS/6000 workstation in another part of the company.



## Brand and Platform Freedom

DESQview/X runs on 386SX PCs and above. And from within windows on those PCs, you can use programs\* running on any number of remote DESQview/X PCs if your network supports NetWare or NetBIOS. Add DESQview/X's optional network interface for TCP/IP networks and you can also access programs running on IBM RS/6000s to HP 9000 to Sun workstations. And it works the other way, too: these workstations can view and use DOS and MS-Windows programs in their windows. \*DOS graphics programs currently run only on your local PC.

## Works the Way You Want

You can change menus, add sub-menus. Add menu items that run remote programs. Change commands. DESQview/X gives you a menu to use for your macros. And if you prefer a graphical desk top instead of a menu, DESQview/X's Application Manager gives you buttons for opening a set of programs used in a project or even for launching remote programs. What's more, you can specify window size and color. And if you are using DOS text programs, you can set them up so that the font changes size as you change the size of the window. We call this feature scalable DOS windows (see the Lotus 1-2-3 window at the lower right of the screen).

## Easy to Set Up and Administer

DESQview/X asks three questions: Do you wish to transfer files to and from other computers? Do you wish to use programs on other computers? and Do you wish other people to have access to programs on your computer? That's all it takes for DESQview/X to set itself up. DESQview/X incorporates QEMM-386 to assure maximum memory utilization and Manifest for easy diagnosis and problem-solving.

# Introducing DESQview/X™ for DOS.

Now everyone can access the power of the fastest PC—or workstation—on the network.

DESQview/X literally turns DOS PCs into graphical workstations. With DESQview/X, you can run DOS and Microsoft Windows programs simultaneously, view them in windows, transfer between them, create DESQview/X-global or program macros and manage your files. That makes computing lots easier, more productive, and more fun.

With DESQview/X, you can now run programs and access files on other computers on the network and view them in windows on your own PC. Distribute tasks among computers based on their capabilities and available resources.

Remote diagnosis and support is now a reality. With DESQview/X you can support, instruct; even remotely demonstrate programs right at your user's computer.

If you have X Window workstations, our optional 'DESQview/X to Other X Systems' TCP/IP Network Manager allows you to run workstation programs remotely from PCs.

For all this power, DESQview/X is stunningly easy to set up and use, and can run on any 386 or 486 PC with as little as 4MB RAM and 40MB hard disk.

DESQview/X multiplies the power of networked PCs by erasing the boundaries between computers; between programs and between users. Welcome to the limitless future of enterprise-wide computing.

Qty	Product	5-1/4	3-1/2	Each	Totals
	DESQview/X			\$275.00	
	DESQview/X Network Mgr. (TCP/IP)			\$200.00	
	OPEN LOOK interface			\$200.00	
	OSF/Motif interface			\$250.00	
Shipping & Handling \$10 (Canada & USA only)					
California Residents add 8.25%					
<b>Grand Total</b>					

Or call (800) 354-3222 ext. 6C5 for faster service

Please allow 3 weeks for delivery

Please Send: ☐ Visa ☐ MasterCard Expires / / Card # \_\_\_\_\_

Name \_\_\_\_\_ Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Registered users of Quarterdeck products are eligible for a special offer. Call (800) 354-3222 ext. 6C5 7AM-5PM PST.

# Quarterdeck



affects performance, it won't be as severe for Mac software. Apple has done extensive code profiling that shows most Mac applications spend 66 percent or more of their time in Mac Toolbox code. If the Mac Toolbox is implemented in RISC code, the application spends most of its execution time in high-speed native RISC code instead of in the slower emulator. The microkernel design will provide a consistent foundation for the operating system to use to access hardware resources, regardless of the processor. Development tools such as

RISC compilers and a 680x0 object binary translator from Echo Logic will be available to facilitate application ports to RISC code.

This strategy means that users will not have to abandon their favorite 680x0 applications to use a PowerPC-based Mac. They can run them with reasonable performance using the system's built-in emulator until applications written in RISC code become available.

Finally, portions of the Mac OS and Mac applications are going to move to other plat-

forms. For example, QuickTime is supported by Silicon Graphics' Unix workstations as a data standard, and a QuickTime player has been demonstrated running under Windows 3.0. Claris has ported its FileMaker Pro database application to Windows, and you can expect more applications to make the move in the near future. □

*Tom Thompson is a BYTE senior technical editor at large. You can reach him on BIX as "tom\_thompson" or on the Internet at tomt@bytepb.byte.com.*

## GUIs, Applications, and Unix

A graphical interface and more popular applications are the keys to Unix's success

MARY HUBLEY

Unix vendors are shifting gears. Their operating system is maturing, and the market has become more competitive than ever before. Rather than obstructing each other in the name of dominance, the vendors are cooperating to make Unix a powerful force within the Intel-based desktop market. Without this cooperation, the traditional non-Unix desktop operating systems will continue to dominate. But if Unix vendors pull together, the desktop market will be the grand prize.

The race for the desktop market has forced rival Unix vendors to collaborate. Archenemies UI (Unix International) and OSF (Open Software Foundation), the two most influential Unix consortiums, are finally working together to form a united front. They perceive Microsoft NT and other desktop operating systems as a threat to Unix, competition powerful enough to eliminate individual Unix vendors from the desktop market. Their strategy is to stand as a united group of vendors, empowering them to successfully combat non-Unix desktop vendors.

Users view Windows and DOS as easy to implement because versions are identical between platforms. To ensure that all Unix versions are similar, all the vendors must implement standards such as Posix, ANSI, Motif, and X/Open XPG. The goal is to make the differences among Unix versions indistinguishable to the end user.

Unix vendors are already working toward these goals. The most important accomplishment has been an industry consensus on a GUI: OSF/Motif. GUIs are



*SunSoft's Solaris adds value to its USL SVR4 core with a built-in GUI.*

critical because features such as desktop icons, drag-and-drop capabilities, and windows make Unix look like its competition. With GUIs, the complexities of Unix are masked. Further, a standardized GUI provides for the same interface regardless of the hardware platform being used.

OSF/Motif has been accepted by a majority of vendors as the standard Unix interface. With a standard GUI, Unix can compete in the ease-of-use category with other desktop operating systems. Motif allows you to do most of what command lines used to do, including sending mail,

opening and manipulating files and applications, and even performing system administration functions. Motif runs on all Unix platforms, increasing its desirability in environments where there are computers from several vendors.

### Applications Compatibility

Applications compatibility among Unix versions also moves Unix closer to desktop acceptance. ABIs (application binary interfaces) allow Unix applications to run on different hardware platforms within an architecture without any recompiling or reengineering. For example, in the Intel architecture, vendors make their binary implementation of Unix conform to the ABI specification. The applications written to the specification should be ABI compatible, allowing, for example, Lotus's shrink-wrapped software to run unchanged on Intel boxes from Unisys, NCR, and Olivetti.

But ABIs are architecture dependent: If you want to run an application on Intel, SPARC, or Mips systems, the application must be reengineered for each CPU. The good news is that Unix versions are similar, and minimal reworking is required—programmers should have to change applications only where there are hardware interfaces and operating-system extensions.

The SVID (System V Interface Definition) ensures that Unix implementations are binary compatible within an architecture, and it defines what an operating system has to look like (i.e., what the interface calls should be) to be ABI compatible. Almost all Unix versions comply with the





N45SL-120 meg, notebook .....	3125
N51SX-80 meg, notebook .....	2795
PS/2 70-121 meg .....	3125
PS/2 40SX-40 meg .....	1655
PS/2 90 OK9, 160 meg .....	5575
*** Monitor Extra ***	



DESKPRO 386/25M .....	1895
DESKPRO 386/33M .....	2125
DESKPRO 486/25M .....	2125
DESKPRO 486/33M .....	2425
DESKPRO 486/50L .....	CALL
Prolinea 3/25S, 86SX/25, 84 meg .....	1295
Prolinea 3/25ZS, 386SX/25, 84 meg .....	1195
Contura 386SL/20, 40 meg .....	1595
Contura 386SL/25, 60 meg .....	1945
*Call for other models - Monitor Extra *	



### Network 386 V.3.11 Authorized Dealer

5 users .....	695
10 users .....	1395
20 users .....	1895
100 users .....	3795
250 users .....	CALL

## BRAND NAMES LOW PRICES

**LEADER  
SINCE 1983**  
*We export to Europe, Asia  
& the Far East*

*We Honor Manufacturer's  
Warranties*  
**Call for details**

### NOTEBOOKS

TI TravelMate 4000, 386SX, 120 meg .....	CALL
Compaq LTE Lite 386SL .....	CALL
Toshiba 2200SX, 80 meg .....	CALL
Toshiba 4400SXC, 120 meg .....	CALL
Toshiba 6400SXC, 120 meg .....	CALL
Toshiba 3300SL, 80 meg .....	CALL

### AST

Exec 386SX/25, 80 meg .....	2150
Exec 386SX/25, 120 meg .....	CALL
Exec 386SX/25C, 80 meg .....	3195
Exec 386SX/25C, 120 meg .....	CALL

Call for pricing on other brand name models



### MEGACUBE EISA BUS

486-33 MHz System 8 meg, 128K Cache, ESDI .....	3695
--	------

### 486/33 MHz System

4 meg, 256K Cache, 1.2 & 200 meg drives, SVGA Combo .....	2995
--	------

### Step 386-33 MHz System

2 meg, 64K Cache, 1.2 & 120 meg drives, 1024x768 SVGA Combo .....	2595
--	------

### Tempo LX 386sx/16 MHz Notebook

3 meg, 60 meg hard drives, VGA .....	1695
--------------------------------------	------



Bravo 386SX/20 model 1 .....	1070
Bravo 386/25 model 1 .....	2295
Premium 386SX/20 model 1 .....	1295
Premium 386/33 model 1 .....	2225

### CD ROM/Multi Media

NEC CD ROM 36M .....	385
NEC CD ROM 73M .....	580
Sound Blaster Pro .....	205

**WE STOCK  
TOSHIBA**

**CITIZEN  
OKIDATA  
EPSON**

**HITACHI  
TALLGRASS  
ARCHIVE**

**NEC  
ALR  
WYSE**

**HOUSTON INSTRUMENTS  
MICROSOFT  
SUMMAGRAPHIC**

**INTEL  
PC MOUSE  
CALCOMP**

## ACS Computers

All systems include

- Intel CPU with 4 meg RAM
- Desktop or tower case
- 2 serial, 1 parallel, 1 game (joystick) ports
- 101 AT enhanced keyboard
- 1.2 (5.25") & 1.44 (3.5") TEAC floppy drives
- SVGA card w/1 meg & SVGA 0.28mm monitor
- MS DOS 5.0 (complete w/manuals)
- MS Windows 3.1 (complete w/manuals) & mouse

486/50 with 200 meg HD .....	2395
486/33 with 120 meg HD .....	1995
386/40 with 120 meg HD .....	1490
386SX/25 with 40 meg HD .....	1195

One year limited warranty

Made  
in  
USA

### LAN BOARDS

8 bit Arcnet .....	75
16 bit Arcnet .....	160
Novell NE 1000 .....	160
Novell NE 2000 .....	175
8 port Active Hub .....	325
Token Ring Card .....	399
Tokenhub 4-port .....	355

Call for other  
LAN Accessories

### SVGA Monitors

NEC 3FGX, 14" .....	665
NEC 4FG, 16" .....	825
NEC 4DS, 16" .....	875
Viewsonic 4E, 14" .....	365
Viewsonic 8, 17" .....	1785
Aamazing, 14" .....	335

### PRINTERS

Epson LQ 570 .....	289
Epson LQ 1170 .....	565
OKIDATA ML320 .....	315
OKIDATA ML390 .....	460
HP DeskJet 500 .....	399
HP PaintJet .....	705
Citizen, Panasonic .....	CALL

### HARD DISKS

#### CONNOR

CP30104 120 meg .....	CALL
CP3204F 220 meg .....	CALL

#### QUANTUM

Pro Drive 120 meg .....	CALL
Pro Drive 240 meg .....	CALL

#### MAXTOR, SEAGATE

#### MICROPOLIS, MICRONET

CALL FOR ALL MODELS

### LASER PRINTERS

HP Laser IIISI .....	3595
HP Laser IIID .....	CALL
HP Laser III .....	1495
HP Laser IIP .....	CALL
HP IIP Plus .....	CALL
OKI OL 400, 800 .....	CALL
OKI OL 840 P.S. ....	1720
Panasonic 4450 .....	1295
NEC Model 95 .....	1465

Corporate Accounts  
Welcome

Call for Discounts  
on Volume

And

Consultant Orders

**Exports  
Available**

# Computerlane inc.

**Outside California: 1-800-526-3482**

**Inside California: 818-884-8644 • FAX: 818-884-8253**

7500 Topanga Canyon Boulevard, Canoga Park, CA 91303

**Hours: Monday - Friday 9 - 6, Saturday 10 - 6**

Compaq is a Registered Trademark of Compaq. IBM is a Registered Trademark of International Business Machines.

ALL QUOTED  
PRICES ARE CASH  
PRICES ONLY

Visa, MasterCard  
and  
American Express  
are higher

Prices subject to change  
without notice.

\*Quantities are limited



SVID, even those not in the System V camp. This includes the next version of OSF 1.1, which Hewlett-Packard, DEC, and IBM are planning to implement. Most other Unix vendors already have SVID, many of whom base their operating systems on Unix System V release 4.0, including NCR, Unisys, The Santa Cruz Operation, SunSoft, and Olivetti.

## Work Continues: The Future ABI

SVID is not the end; more work must be done on ABIs. The most pressing area of development is in value-added Unix, where vendors enhance their versions by adding extensions (e.g., built-in GUIs, real-time facilities, and extra administrative tools). However, value-added extensions affect compatibility.

For instance, Unix SVR4.2 is SVID-compatible with other SVR4 versions. But SVR4 is licensed to other vendors, many of whom add value to their versions, which affects their compatibility. SunSoft's Solaris is an example of a value-added SVR4 because it has a built-in GUI (see the screen). Incompatibilities between SVR4.2 and Solaris exist on the GUI level, but the two operating systems are compatible be-

neath the interface. Thus, if you take away Solaris's GUI, you can still use SVR4 applications. Although SunSoft and Unix Systems Laboratories are devoting a great deal of time to the development of commonality between Solaris and SVR4.2, this problem signals a larger trend in Unix operating systems: Value-added graphical operating systems (e.g., Solaris) are here to stay.

GUI-based Unix systems are especially important in the desktop market, where ease of use and ease of training are critical issues. According to David Sandel, UI's vice president of worldwide marketing, "Unix products obviously have the graphics capabilities, but they're not compatible. Without support for graphical-based systems in the [ABI] standard, we won't get enough shrink-wrapped software to compete on the desktop."

## Applications Software

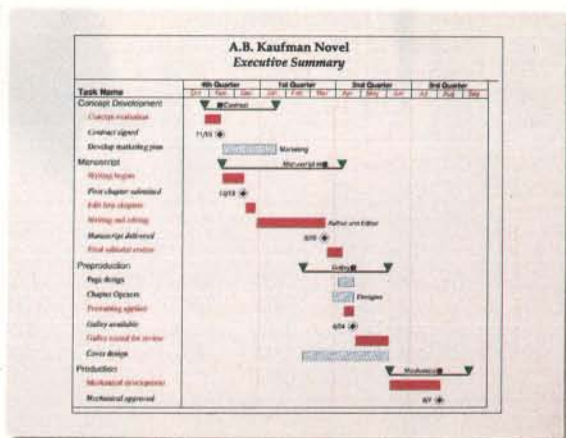
Applications software is the real battleground. If Unix vendors want to devour desktop dollars, DOS and Windows applications had better be available for their systems. The desktop market demands PC applications. Even though there are thou-

sands of scientific and commercial applications written for Unix, PC users want the applications they know best. Most people will not learn a new application or spend any money for training if the old application works just as well or better than the new one.

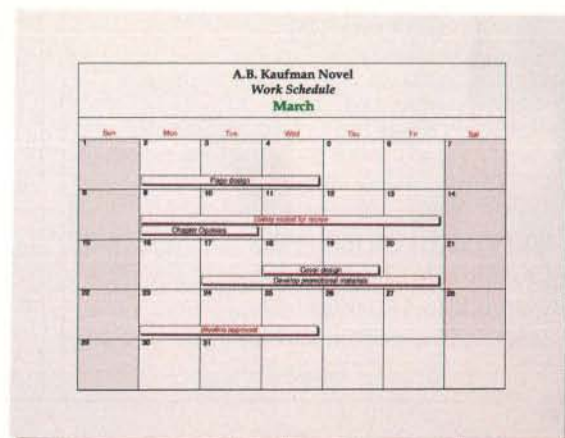
Popular applications in the PC world began working their way over to Unix a couple of years ago. Today, the most successful PC products are running on Unix, including Lotus 1-2-3, Microsoft Word, and WordPerfect 5.0. However, only the best-known applications have a Unix equivalent. The majority of DOS applications are simply not available for Unix. Businesses depend on their critical applications; they cannot afford to change just because an operating system provides better programming, scalability, or vendor independence. For those critical applications that are not available in Unix versions, many companies have explored the following alternatives.

*Emulators*, such as SoftPC from Insignia Solutions, are probably the easiest solution. They simulate DOS on a Unix system. The downside to this technique, however, is that they make applications run as

## The CEO wants to know when it will be finished.



## The staff wants to know when they can start.



As a project manager, you've seen it all before. Everyone who needs to know, all too often, needs to know something different. Which is why there's new Microsoft Project version 3.0 for Windows."

It not only makes it easy to present

things the way *they* want, but also lets you plan things the way *you* want.

Now you can enter and view data in a variety of ways—Gantt, tables, graphs, forms and more. Microsoft Project also has a customizable Toolbar, giving you access



slowly as they would on a 286-based PC.

**Plug-in boards** that slide into a CPU slot, such as SunConnect's SunIPC, also allow Unix machines to run DOS. Unfortunately, they cost more than software emulators.

**Virtual-mode simulators**, such as Merge from Locus Computing and VP/ix from SunSoft, use the virtual 8086 mode of 386 and 486 processors to simulate PCs running DOS. Virtual-mode simulators allow several DOS applications to run simultaneously and let Unix run in a shell under DOS.

**Porting** is the most time-consuming solution. It requires extensive rewriting of an application, but the resulting software becomes truly Unix-based. Hunter Systems' XDOS has been used by many companies to assist in porting efforts, expanding such notable products to the Unix market as Borland's dBase and XyQuest's XyWrite.

**Networking** offers another way to make DOS and Unix systems work together, and it allows an easy migration from DOS-only operations. Two methods are generally used: Unix file servers can be added to PC LANs, or PCs can be modified to communicate in Unix Ethernet networks. In

the first method, Unix file servers can be accessed through LAN operating systems (e.g., Novell's NetWare for Unix and Microsoft's LAN Manager for Unix). These operating systems provide DOS PC users access to Unix file-server facilities such as E-mail, file and resource sharing (e.g., printers), and remote access. In the other method, Unix-based Ethernet networks afford PCs access to Unix networks without a server. Resources can be shared through TCP/IP and related software and Ethernet adapter boards.

## So, What's the Future?

The biggest trend is GUI-based desktop Unix. SCO Open Desktop was the first in the field, and now others are following suit by converting their character-based Unix versions to graphical-based packages. In addition, as Motif becomes universally accepted, the number of applications that can run on Motif is growing rapidly.

Why should you buy Unix instead of Windows, OS/2, or other operating systems running on the desktop? Because it offers more flexibility: It's the only operating system that can be expanded to the mainframe. Networking capabilities are

## Key features

- Consistent GUI across platforms
- Application compatibility across platforms
- Only operating system expandable to mainframes
- Built-in networking
- Large command set

## Future enhancements

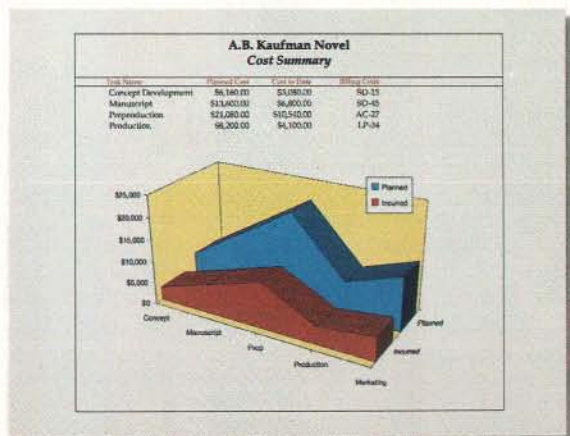
- Real-time services
- Desktop versions from key vendors, such as SunSoft
- Built-in GUIs
- Extra administrative tools

## Drawbacks

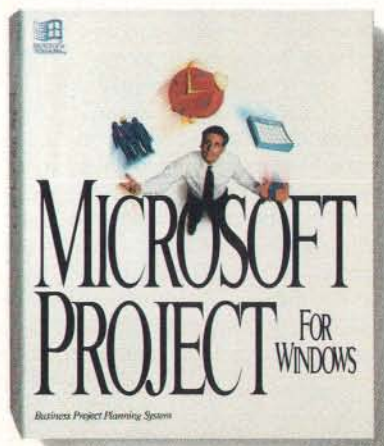
- Shortage of shrink-wrapped applications
- GUI-level incompatibilities among versions
- Negative market perceptions
- No easy way to run PC applications

built in. And the command set is huge, allowing Unix to accomplish more complex

## The controller wants to know how much it will cost.



## We want to know what you're waiting for.



to the functions you use most with a click of the mouse. While PlanningWizards give you online assistance to help develop plans.

What's more, new Microsoft Project has WYSIWYG and Multi-Page Print Preview, so plan on visiting the printer less.

For your upgrade or the name of a reseller, call (800) 541-1261, Dept. X13. You'll satisfy a lot more people. Including yourself.

**Microsoft**  
Making it easier



tasks than its desktop counterparts. In addition, if you want to take advantage of the powerful RISC-based platforms, Unix offers you the widest choice.

Beyond technical advances, marketing is key to Unix's success on the desktop. It is up to the Unix vendors to drive the Unix market on the desktop. They must bring in independent software vendors,

show them the growth potential of Unix, and assist in porting their software. The vendors must also educate end users about Unix's benefits and demonstrate its new ease of use and its complete compatibility among versions.

Price, ease of use, and a wider selection of applications has made DOS and Windows successful. Only by meeting the

competition head-on will Unix triumph on the desktop. □

*Mary Hubley is senior editor of Datapro Reports on Unix Systems & Software, a publication of the Datapro Information Services Group of McGraw-Hill devoted to the Unix and open-systems markets. You can reach her on BIX c/o "editors."*

## NextStep: The Sleeper

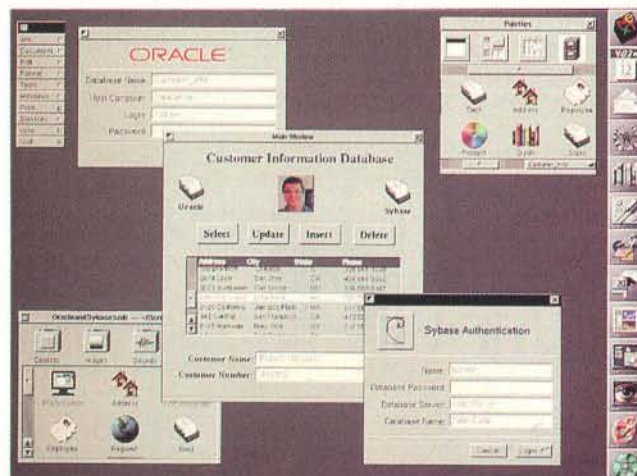
Next's object-oriented operating system offers now what others promise for later

TOM YAGER

From anyone's perspective, Next has chosen an unusual tack. On the hardware side, Next has taken up Motorola CISC processors (i.e., the 680x0) at a time when traditional backers (e.g., Sun) are abandoning them. Next systems are inexpensive compared to other Unix workstations, but that has its price: These systems have almost no internal expansion capability (save memory and disk), and the only case opening in Next's fashionably black pizza box is for a floppy drive. But you won't hear any Next users complaining; most of them are fanatically devoted to their systems.

The beauty of the Next is far more than skin deep. Its standard operating environment, NextStep, is probably the most respected piece of software on the planet. The reason it attracts so much attention is that, unlike almost every other popular operating system, NextStep doesn't short-change anyone. Users, developers, and integrators all reap the benefits of NextStep's object-oriented scheme. No one who works with a Next machine feels like a second-class citizen. In contrast, the immensely popular Windows environment does not extend its benefits to developers, at least not if those developers use Microsoft's own C/C++ tools (which run under DOS).

That NextStep makes its users happy is obvious (see the screen). A distinct departure from traditional Unix systems, everything on the Next is handled graphically, and the average user never deals with the operating system or even realizes it's there. It retains the Mac-style global menu (a single menu bar that changes depending on which application has the focus), but on the Next, the menus are presented in movable vertical windows. Icons for commonly used applications are gath-



*The NextStep interface makes it the easiest-to-use Unix. It features icons for commonly used applications and a Mac-style global menu.*

ered along the edges of the display, and any running application displays an icon that you can double-click on to instantly move its window to the top of the stack and make it the focus. The Next uses a Unix-style hierarchical file system, and a graphical browser is provided.

The combination of NextStep's interface features makes it, by far, the easiest Unix system to use. It reigns as the best example of Unix done right: It's aimed at ordinary users rather than traditional Unix users. Because of all this, the Next is finding its way into domains that were once dominated by PCs and Macs.

Next's ease of use doesn't limit its functionality, because networking and E-mail, distributed applications, integrated audio, network printing, and other desirable functions are all wrapped in point-and-click interfaces that make them accessible to all classes of users. That's all standard with NextStep. While there are third-party enhancements for other systems that provide

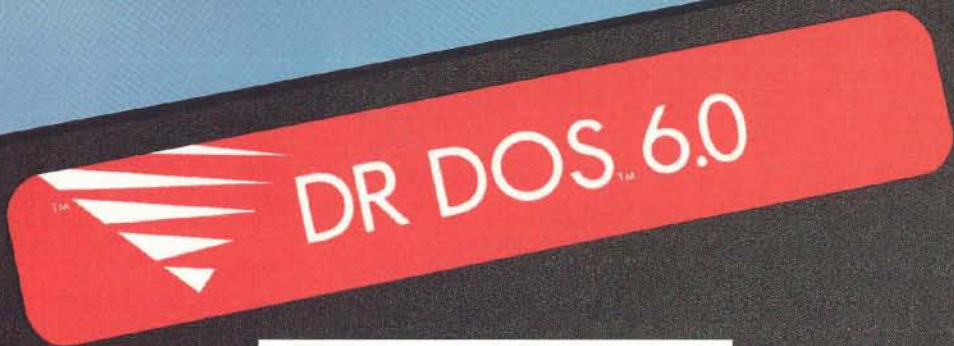
pieces of that functionality, Next is the only vendor bundling all of it with every system it sells.

### Treated Like an Object

The underlying reason for Next's success is objects. Where traditional Unix treats everything as a file, NextStep understands and manages objects at an operating-system level.

The developers benefit from the system just as much as the users because the development environment for NextStep applications uses GUI power to make the process easier to manage. Blocks of code become objects that programmers can paste into other applications. Changes take place at the object level, and as long as the new object understands the same message set as the one recognized by the object before it, you are not required to chase around and change other modules. This modularity is not layered. Objects are an integral part of NextStep, and the object-





POWER.



SHARING.

Now, together in one pack with a combined value of £100, the team that builds teams. DR DOS 6.0, the award-winning, revolutionary PC operating system and NetWare Lite v1.1, Novell's renowned entry-level networking software for the smaller business or work group.

Snap up this strictly limited offer, and you'll reap the benefits of both for a mere £49.

NetWare Lite v1.1 provides total connectivity for up to 25 computers, facilitating the sharing of printers, software and data. It's easy to install and easier to use.

The menu utility makes it simple to change printers, send messages, locate files – and an

on-line Help facility instructs your operators while they work. DR DOS 6.0 doubles a PC's hard disk space, increases the speed of data retrieval by up to five times, maximises memory for software programs and is designed to work hand-in-glove with Windows 3.1.

DR DOS 6.0 gives you the power to increase the efficiency of your business. NetWare Lite v1.1 distributes that power to wherever it is needed.

Together, they're a double act our competitors will find impossible to follow. To take

advantage of this special offer, call one of our Novell offices listed.



**\$79.**

United Kingdom (0) 800 666767.  
Austria and Germany 49 (0) 211 59730.  
France 33 (1) 47750909.  
Spain and Portugal 34 1 577 4941.  
Benelux 32 27 25 0200.  
Switzerland 41 1 87 006 50.  
Sweden, Norway, Denmark,  
Finland, Greece and Israel  
44 (0) 635 31353.



The Past, Present, and Future  
of Network Computing.



oriented development environment is included with every system.

Thanks to NextStep, the Next has found its greatest appeal in the corporate community, where systems are configured for specific needs. NextStep makes customizing a system easier than anything else I've seen. Applications become icons, and the development tools make it easy (and, I dare say, fun) to create custom graphical applications that, thanks to NextStep's standard object library, look and act as good as any commercial program. What might take days of procedural programming to accomplish elsewhere can be reduced to a few hours of tying existing objects together under NextStep.

If your application is graphical or depends on high-quality text, you have the full power of Display PostScript at your disposal. And once you've invested that effort, you know that what you've built will run on any Next in (or out of) the house. The level of applications you can create in the standard environment is much higher on Next than anywhere else.

Next machines incorporate an ease of networking previously found only on the Mac. Every machine has Ethernet, and all it takes to get Nexts talking to each other is to plug them into the same thin-wire or twisted-pair LAN. A new system will register itself at boot time with a designated configuration server. Without any further effort, the system immediately gains ac-

cess to all public resources. This, too, is a boon for large installations, because it reduces system setup to finding desk space and outlets.

#### Coming Soon to a PC near You

For the moment, only users of Next's own workstations can experience these benefits. But perhaps as early as the end of the

year, NextStep 3.0 will be available for 486-based PCs for under \$1000 (\$2495 for the developer's version).

Aside from the new platform support, NextStep 3.0 will also make NetWare and AppleShare client-network access standard. It also adds Mac file-system support, reading Mac floppy and hard disks and making them appear as Next file systems. A database kit will allow programmers to create object-oriented programs that transparently access popular networked databases. This new release also introduces distributed objects, extending NextStep's object messaging to allow objects to reside anywhere (e.g., within the same application, on the same system, or across a LAN or wide-area network).

Next has the advantage of already being where most other workstation manufacturers would like to be. While everyone is reportedly making ease of use and developer support priorities now, Next had those primary goals from the start. There isn't any high-performance machine that offers as many benefits for so little money and effort. As the application count rises (there are fewer than 300 applications for the Next, not counting the custom programs that NextStep supports so well), NextStep will doubtless be seen on many more desks. □

*Tom Yager is a BYTE technical editor. You can reach him on BIX as "tyager" or on the Internet at tyager@byteph.byte.com.*

# Univel's Trim Unix

UnixWare looks great, and it's less filling

MATT TRASK

In a time when *downsizing* has too many negative connotations, Univel, the joint venture of Novell and Unix Systems Laboratories, has used the term *rightsizing* to describe the use of its new UnixWare product as a solution for mission-critical applications. Univel has aimed UnixWare squarely at the Fortune 1000 market.

UnixWare will be sold in two versions—a Personal Edition for single-user desktop systems and an Application Server for multiuser and network server use. The Personal Edition can run on a 16-MHz 386SX system with 6 MB of RAM, but the recommended configuration is a 25-MHz 386SX or higher with 8 MB of RAM and

a 120 MB hard drive. Application Server can run on a similarly configured system, but the recommended environment is a 33-MHz 486 with 12 MB of RAM and a 200 MB hard drive.

#### Just the Essentials for the Desktop

The main attraction of UnixWare is that it has been slimmed down significantly to operate on smaller desktop systems. How was such a feat accomplished? Several years back, a guru described Unix as "a small, fast, efficient, portable operating system, upon which every graduate student in the universe has played pin the tail on the donkey." A great deal of the difficulty and bloat associated with Unix was

brought on by the inclusion of hundreds of utility programs, such as *tar*, *uucp*, and *cpio*.

Univel has removed much of this extraneous functionality and replaced it with an easy-to-use GUI and a set of system administration tools for tasks such as installation and backup. The GUI offering is based on X Window System 11 release 5 and includes both the Open Look and Motif desktop managers (see the screen). Installation is said to be as simple as that for Windows 3.1, and it can be performed from a CD-ROM or a network as well as from a disk or tapes.

Perhaps the most significant break with the past is the implementation of Novell's

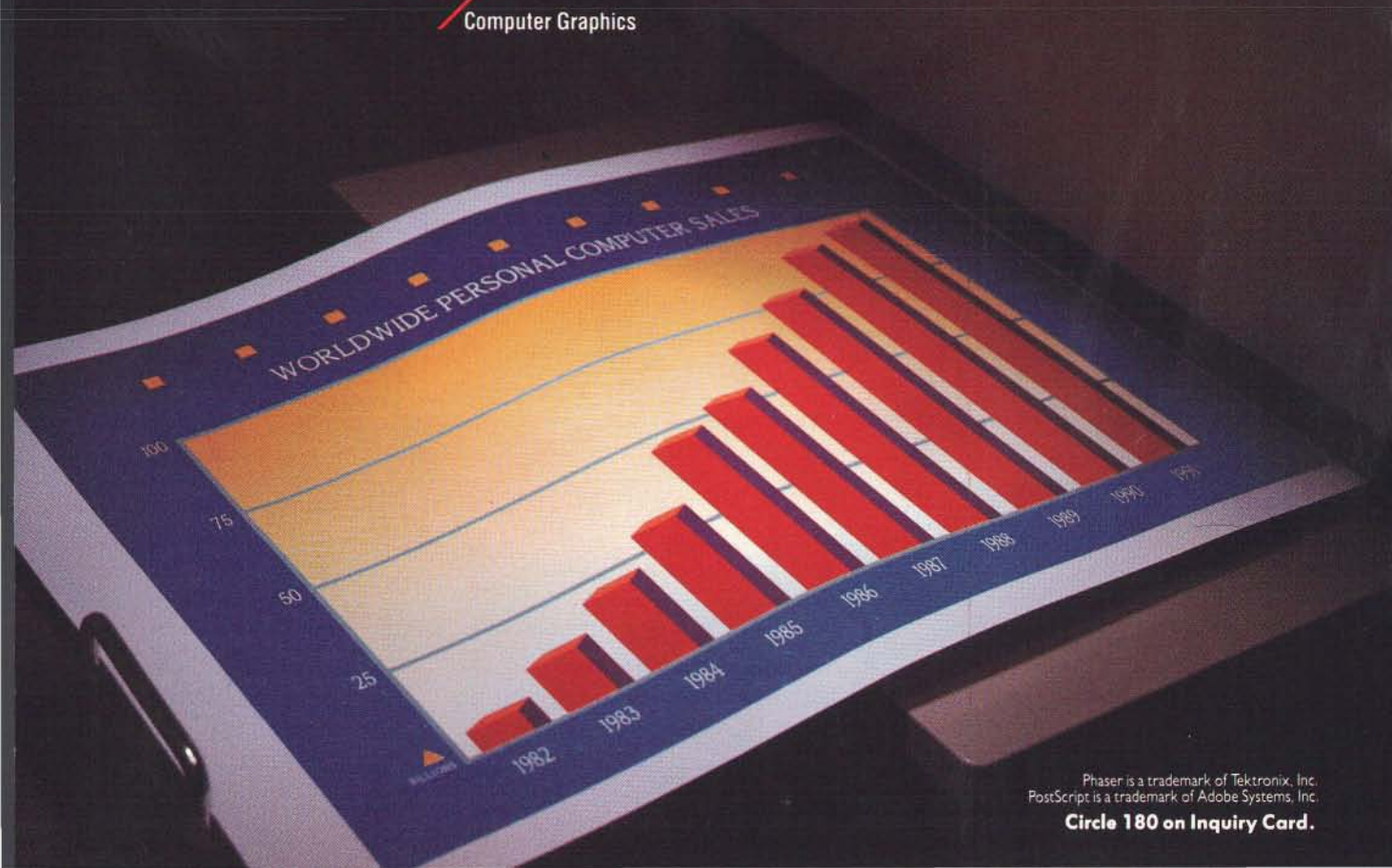


# Rich color isn't just for rich guys.

The Tektronix Phaser™ II PXe color printer produces 16.7 million of the world's brightest, most vivid colors. It has a 16 MHz RISC processor on-board so it's as fast as you are. It supports Adobe PostScript Level 2 and HP-GL, it's networkable and can perform with PCs, Macintosh and workstation applications. It prints especially well on transparencies, too. And at less than \$5000, you get an award-winning printer with all the latest features at an extremely affordable price. Call the leaders in color printing at 1-800-835-6100 Dept. 26J for a free output sample. Or call (503) 682-7450, ask for Document 1215 and we'll send information by fax. And get the color you need. At a price you can afford.

**Tektronix**

Computer Graphics



Phaser is a trademark of Tektronix, Inc.  
PostScript is a trademark of Adobe Systems, Inc.

Circle 180 on Inquiry Card.



# Hard Drive Installation and Diagnostics



## Made Easy.

Now, adding a hard drive to your system is as easy as typing "install." There's no need to know DOS or complicated commands. SpeedStor automatically performs all of the operations to make your drive "data ready." And to keep your drive "data safe," SpeedStor contains critical diagnostics not found in DOS — diagnostics that safeguard your valuable data and ensure your hard drive is trouble free.

Available at Best Buy, Egghead Software, Computer City Supercenter, CompUSA, Elek-Tek and Software Etc. Order today, call 1-800-344-4323.

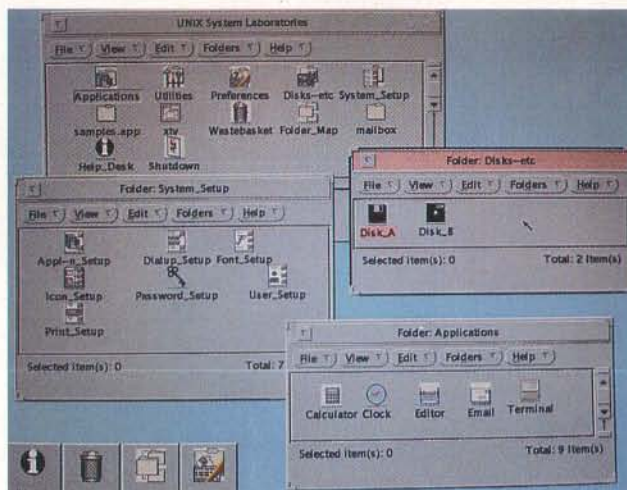
 STORAGE DIMENSIONS

# SpeedStor

Storage Installation And Diagnostic Software

SpeedStor is a registered trademark of Storage Dimensions.  
©1992 Storage Dimensions

## UNIVEL'S TRIM UNIX



*UnixWare's GUI offering is based on the X Window System and includes both the Open Look and Motif desktop managers. The screen here is actually USL's SVR4.2, on which UnixWare is based. Except for minor differences in the icons and header bars, the screens will be similar.*

networking protocols (including IPX/SPX, NCP, and SAP) directly into the Unix kernel. This will allow transparent interoperability with NetWare LANs, which are used in the corporate environment. The traditional Unix connectivities that are based on the NFS (Network File System) and TCP/IP networking protocols are available as an add-on package and are still necessary for connecting UnixWare systems to the Internet and other Unix systems.

UnixWare Application Servers will not be able to run NLM (NetWare loadable module) applications, but developers can create new distributed-server applications that take advantage of this environment. Univel claims that UnixWare is capable of running all the traditional Unix applications, as well as DOS and Windows programs, without any performance degradation.

The expected development tools (e.g., an ANSI C compiler and debugger) are available as an optional package. Other development kits provide support for NetWare programming, device driver devel-

opment, and GUI programming. A package called Moolit is available for GUI development with both Motif and Open Look. Programmers can also choose to develop command-line or full-screen type applications.

Univel's use of the USL Unix System V release 4.2 kernel provides significant security enhancements over older versions of Unix. The standard security level is certifiable at C2 and can optionally be tightened to B1 or B2. In contrast, DOS and Windows cannot be certified as secure, and Windows NT will be certifiable at the C2 level.

### Things to Come

What is the status and the availability of UnixWare? During the summer, the initial releases were shown to a limited audience, and a full beta test program was planned for August. The final product is expected to ship to end users this fall.

Unix has always been a hacker's heaven and a great development environment for programmers. It has held a stable niche in the computer market for a great many years, during which true believers insisted that someday Unix would take over the desktop. They said all that was required was to hide the command line with an attractive graphical front end and to provide easy-to-use system administration tools.

Univel has done this. The improved connectivity to corporate LANs, ease of installation, and removal of extraneous functionality should make this new product much more accessible to desktop end users. ■

*Matt Trask is president of Communica, a system software consulting firm based in Cape Cod, Massachusetts, that specializes in personal computers. You can reach him on BIX as "matt.trask."*

### Key features

- Runs easily on a standard Intel-based desktop
- Open Look and Motif desktop managers
- Simplified installation
- Integration of Novell's networking protocols
- Good security

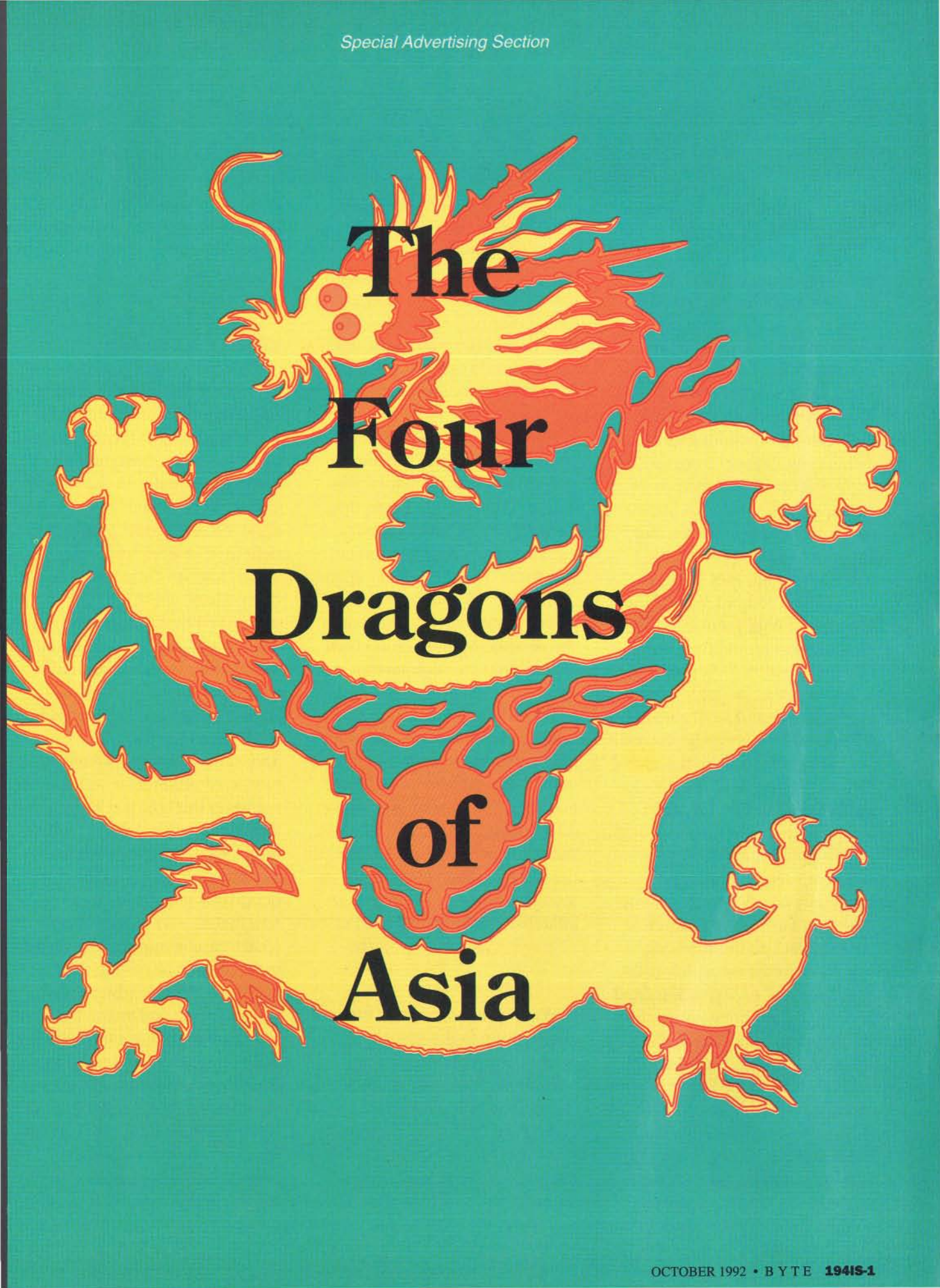
### Future enhancements

- None announced

### Drawbacks

- Cannot run NetWare NLMs





# The Four Dragons of Asia



# The Four Dragons of Asia

**R**ecent years have seen widespread economic development in Asia in which the burgeoning Asian computer industry has played no small part. As the newly industrialized countries of the "Four Dragons," Taiwan, South Korea, Hong Kong and Singapore, have flexed their economic muscle, their computer manufacturers, with strong support from the region's economic superpower Japan, have expanded in leaps and bounds to become a major factor in the PC industry. We'll make a brief odyssey here through the present state of the industry in Asia, focusing mainly on the Dragons and their current place in the global PC scene.

As the Asian industry has grown in size and sophistication it has come to play a significant, if not yet defining role in the global picture. Within Asia, the developing industries of the Dragons have charged onto the scene with great vigor, if not always prudence or savvy. Sometimes backed by conglomerates, sometimes not far from the American garage R&D tradition, young engineers, often returning with education and experience gained in America, are helping to define the direction of high-tech, high-value development in Asia.

If you look at the Dragons, you soon find the widespread influence of the two industry giants, Japan and the United States. With widespread behind-the-scenes influence on basic technology,

product design and component supply, these two exert considerably more influence on the regional industry than is apparent at first glance. As we examine the increasingly influential role the other Asian manufacturers are playing in the world market, the extent of their presence becomes clear.

Although they share some common features, the structure and activities of the industry in each of the Dragons are so disparate that you have to look at each one individually to understand much about them or appreciate their collective effect. It is useful to look at each one from the perspective of several broad themes that create a portrait of their current state.

While most of each one's industry is focused on hardware manufacturing, trends and developments in software, design and marketing are having a growing effect on their direction. The mix varies in each country, but the net effect is complementary and indicates a role of accelerating influence on the global market.

When you look at the Dragons' contribution to the global PC market, the main sector they influence is hardware manufacturing. The original basis for these local "miracles" of development was the development of a manufacturing base. The computer industry has been no differ-

ent. Today, a majority of the industry still produces product mainly for OEM customers. Even among companies that have developed their own brands, they have been built on the base of a strong OEM foundation.

This has led to some interesting misconceptions about the Asian industry. Much as Japan worked hard to overcome an initially deserved reputation for inadequate quality in the '50s and succeeded in meeting, exceeding, and ultimately contributing to the definition of world-class quality standards, the Dragons have come a long way from their checkered beginnings. The days when the public announcement of having a legal mainboard BIOS was an important marketing requirement have long passed. Both South Korean and Taiwanese companies have mass produced product for well known names in the U.S. and Europe for some years now, yet they still suffer from disparaging comments and imputations about their product quality and design from quarters that should know better. Quarters, one might add, who are most likely to be casting their aspersions from hardware made, at least in part, in Dragon factories.

Although manufacturing is the main strength in all four Dragons, their industry structure varies significantly. The industry in Hong Kong and Taiwan is based on a large number of small to medium-sized companies, following the general model of develop-

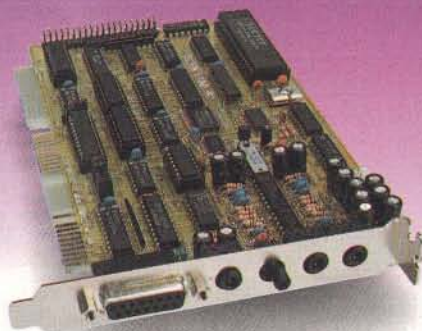




## GOLDEN SOUND CARD

**THE UNIQUE SOUND CARD IS  
COMPATIBLE WITH 4 SOUND &  
MULTIMEDIA PC STANDARD,  
AND BUILT-IN STEREO SURROUND  
EFFECT IN THE WORLD.**

MPU-401 (UART) MIDI, GS/MT-32 INSTRUMENTS,  
SOUND BLASTER, MULTIMEDIA PC AND  
ADLIB SOUND CARDS COMPATIBLE!



### ■ GOLDEN SOUND VER 2.5 & 3.0 MULTIMEDIA SOUND CARD

1. COMPATIBLE WITH ALL SOUND BLASTER'S SOFTWARE
2. COMPATIBLE WITH MPU-401 (UART MODE) & GS/MT-32 INSTRUMENTS

- BUILT-IN MIDI INTERFACE OF MPU-401 (UART MODE) & SOUND BLASTER MIDI COMPATIBLE
- BUNDLE SIMULATE SOFTWARE OF GS/MT-32 INSTRUMENTS
- SUPPORT ALL MIDI SOFTWARE OF MPU-401 (UART MODE) COMPATIBLE
- SUPPORT ALL SOUND GAME SOFTWARE OF GS/MT-32 INSTRUMENTS COMPATIBLE
- SUPPORT THE MICROSOFT WINDOWS 3.1 & MULTIMEDIA EXTENSIONS 1.0
- OPTIONAL MIDI CABLE

#### 3. SAMPLING RATE

- INPUT : 1KHZ-20.8KHZ/8 BIT PCM
- OUTPUT : 1KHZ-48KHZ/8 BIT PCM
- TO SET COMPRESSION & DECOMPRESSION IN HARDWARE
- COMPRESSION RATE - 4:1, 3:1, 2:1

#### 4. VOICE OUTPUT

- PHONE OUT : CONNECT WITH STEREO EAR PHONE OR NON-AMPLIFIER SPEAKER.
- LINE OUT : CONNECT WITH AUDIO POWER AMPLIFIER NON-SIGNAL NOISE & NON-DISTORTION.
- OUTPUT POWER AMPLIFIER: 4W

#### 5. VOICE INPUT

- LINE IN : ALLOW TO BE DIRECTLY RECORD INTO COMPUTER FROM WALKMAN, CD-ROM DRIVE OR AUDIO MACHINE THROUGH RECORDING WIRE OR MICROPHONE JACK (WITH MONITOR FUNCTION WHILE YOU ARE RECORDING)

#### 6. FM IC CHIPS

- YAMAHA 3812/3014 FM SYNTHESIZER IC CHIPS
- FULLY COMPATIBLE WITH ADLIB SOUND CARD
- 11 SOUND CHANNELS (6 MELODY CHANNELS & 5 PERCUSSION CHANNELS OR 9 MELODY CHANNELS)

#### 7. MIXER EFFECTS

- BUILT-IN MIXER EFFECT CIRCUIT
- MIX FM, DIGITIZED VOICE, LINE-IN & CD-ROM

#### 8. IRQ/DMA & I/O SELECTABLE

- IRQ - 2.5 OR 7 SELECTABLE
- DMA - 1 OR 3 SELECTABLE
- I/O - 220 OR 240 SELECTABLE

#### 9. MULTI-FUNCTION ADAPTOR

- BUILT-IN MIDI OR GAME, LINE IN/OUT (L&R), PHONE OUT ADAPTOR AND VOLUME CONTROLLER
- BUILT-IN PC SPEAKER JUMPER

#### 10. CD-ROM :

- BUILT-IN CD-ROM AUDIO SIGNAL CONNECTOR
- MIX WITH FM & VOICE
- CAN BE FOR BACKGROUND MUSIC
- CD-ROM INTERFACE CARD OPTIONAL (AT BUS OR SCSI)

#### 11. GAME I/O PORT

- BUILT-IN STANDARD GAME I/O INTERFACE & ADAPTOR
- SUPPORT ALL IBM COMPATIBLE JOYSTICKS

### ■ THE EXTRA FUNCTION FOR VER.3.0

1. BUILT-IN AT-BUS WITH SONY CD-ROM INTERFACE AND SURROUND EFFECT CIRCUIT
2. VOICE INPUT WITH MIC-IN
3. BUNDLED WITH MULTIMEDIA DEVELOPER TOOL BOX & GS DEVELOPMENT LIBRARY

### ■ GOLDEN SOUND PRO II & PRO III MULTIMEDIA STEREO SURROUND CARD

1. COMPATIBLE WITH MULTIMEDIA PC SOFTWARE
2. FULLY COMPATIBLE WITH SOUND BLASTER'S SOFTWARE

3. SUPPORT MICROSOFT WINDOWS 3.1 & MULTIMEDIA EXTENSIONS 1.0

4. COMPATIBLE WITH MPU-401 (UART MODE) & GS/MT-32 INSTRUMENTS

- BUILT-IN MIDI INTERFACE OF MPU-401 (UART MODE) & SOUND BLASTER MIDI COMPATIBLE
- BUNDLE SIMULATE SOFTWARE OF GS/MT-32 INSTRUMENTS
- SUPPORT ALL MIDI SOFTWARE OF MPU-401 (UART MODE) COMPATIBLE
- SUPPORT ALL SOUND GAME SOFTWARE OF GS/MT-32 INSTRUMENTS COMPATIBLE

#### 5. STEREO SURROUND EFFECT

- BUILT-IN YAMAHA 7128 SURROUND IC CHIP AND CIRCUIT
- STEREO SURROUND EFFECT

#### 6. SAMPLING RATE

- INPUT : 1KHZ-24.0KHZ (STEREO)/8 BIT PCM (PRO II) 1KHZ-44.1KHZ (STEREO)/8 BIT PCM (PRO III)
- OUTPUT : 1KHZ-24.0KHZ (R&L STEREO)/8 BIT PCM (PRO II) 1KHZ-48.0KHZ (MONO)/8 BIT PCM (PRO II) 1KHZ-48.0KHZ (STEREO)/8 BIT PCM (PRO III)
- TO SET COMPRESSION & DECOMPRESSION IN HARDWARE
- COMPRESSION RATE - 4:1, 3:1 & 2:1

#### 7. CD-ROM INTERFACE

- BUILT-IN AT BUS CD-ROM INTERFACE (DRIVE - MODEL: CR-521-B) OR (CR-522) (PRO II)
- BUILT-IN SCSI CD-ROM INTERFACE (PRO III)
- BUILT-IN CD-ROM AUDIO CONNECTOR/MIXER
- IT CAN BE FOR BACKGROUND MUSIC

#### 8. VOICE OUTPUT

- LINE OUT : DIRECTLY OUTPUT TO AUDIO POWER AMPLIFIER, NON-SIGNAL NOISE & NON-DISTORTION.

#### 9. VOICE INPUT

- MIC IN : IMPEDANCE 600  $\Omega$ , 3.5MM INPUT JACK
- LINE IN : ALLOW TO BE DIRECTLY RECORD INTO COMPUTER FROM WALKMAN, CD-ROM DRIVE OR AUDIO MACHINE (WITH MONITOR FUNCTION WHILE YOU ARE RECORDING)

#### 10. FM IC CHIPS

- YAMAHA STEREO 262/512 FM SYNTHESIZER IC CHIPS
- FULLY COMPATIBLE WITH ADLIB SOUND CARD
- 22 SOUND CHANNELS

#### 11. MIXER EFFECTS

- BUILT-IN MIXER EFFECT CIRCUIT
- MIX FM, DIGITIZED VOICE, CD-ROM, NATURE VOICE (MIC-IN) AND LINE-IN ... ETC.

#### 12. IRQ/DMA & I/O SELECTABLE

- IRQ - 2.5 OR 7 SELECTABLE
- DMA - 1 OR 3 SELECTABLE
- I/O - 200 OR 240 SELECTABLE

#### 13. MULTIMEDIA FUNCTION BOX (OPTIONAL)

- POWERFUL DESIGN & EASY FOR USING
- BUILT-IN MIDI IN/OUT, LINE IN/OUT (L&R), MIC IN/VR CONTROL & PHONE OUT ADAPTOR AND VOLUME CONTROLLER
- BUILT-IN 20W AMPLIFIER & HI-FI STEREO SPEAKER
- BUILT-IN HI-FI AM/FM RADIO

#### 14. GAME I/O PORT

- BUILT-IN STANDARD GAME I/O INTERFACE & ADAPTOR
- SUPPORT ALL IBM COMPATIBLE JOYSTICKS



**TOPTEK MICRO  
COMPUTER INC.**

Head Office & Factory:

TOPTEK Micro Computer Inc.  
5F, No. 11, Lane 163, Shing-Yi Rd.,  
Panchiao City, Taiwan, R.O.C.  
TEL : 886-2-964-7096  
FAX : 886-2-961-9586  
BBS : 886-2-964-7081



**COMDEX/Fall '92** November 16-20, 1992  
Las Vegas, Nevada USA

**See Us At #S1238**

U.S. Office & Service Center:

TOPTEK Computer (U.S.A.) Inc.  
2000 Wyatt Drive, Suite 2  
Santa Clara, CA 95054, U.S.A.  
TEL : (408) 727-4500  
FAX : (408) 727-4586

SINGAPORE Office:

STE International (Singapore) Pte Ltd.  
211 Henderson Road #03-03,  
Singapore 0315  
TEL : (65) 274-8448  
FAX : (65) 273-7226

\* ALL TRADE NAMES AND MARKS ARE REGISTERED TRADEMARKS OF RESPECTIVE COMPANIES.

Circle 358 on Inquiry Card (RESSELLERS: 3501)



ment in both places. While their structure and size allow them great flexibility in responding to market trends, few companies reach the critical mass necessary to do more than respond to trends and designs from elsewhere. Serious, independent research and development is still largely out of reach for most.

This is not the problem it might seem however. In Taiwan, the government took an early and substantial interest in its nascent information industry, creating a wide-ranging government support structure, investing heavily in research facilities and organizations and ensuring a very favorable tax and financial environment for company start-ups. The effort continues today and has also substantially, though indirectly, aided the Hong Kong industry which benefits through its close ties to Taiwanese suppliers.

Although Taiwan continues in its main role as OEM supplier extraordinaire, supplying a major share of the worldwide market, for the most part indirectly, some Taiwanese companies are making vigorous efforts to come out of the shadows and establish a visible presence in the global market. Perhaps the most recognizable to date is Acer, which has successfully built brand recognition, spent significantly on real R&D, and at the same time begun to suffer some of the economic pains of being a full player in the big leagues.

In Hong Kong, marketing savvy stands out as one of the significant assets of the local industry. Benefiting from the colony's position as a commercial crossroads of Asia and the sophistica-

tion and acumen borne of having been so for more than a century, Hong Kong's PC entrepreneurs make maximum use of their association with Taiwan and their access to cheap labor and the exploding economy across the border in the PRC's Guangdong province. Faced with higher labor costs at home and a shortage of locally trained engineers, they have turned their geographic and political position into a winning combination that is seeing continued rapid growth.

In South Korea, where the development model is quite different, large industrial conglomerates, or chaebol, have and continue to be at the forefront of the industry. Much larger and with substantially greater resources, their computer divisions have had an early involvement in the full range of manufacturing, producing everything from integrated circuits to components to full systems. Names like Hyundai, Daewoo and Goldstar, known in the global marketplace for products from other divisions, have been large players behind the scenes in information technology and are beginning to appear in their own right as they too tire of being the power behind the glory of their OEM clients abroad and develop their own brands. With Hyundai launching its own line of desktop PCs and Daewoo coming out of the shadows to rescue and revive failing Leading Edge, Korean manufacturers look poised for a marketing push that may help reinforce the trend among most of the larger Dragon companies to attempt the same effort.

In Singapore the local indus-

try, more than any of the others, is based on large world-class manufacturing facilities operated by major international players from Europe and America. Almost the center of hard disk drive manufacture in Asia, Quantum, Maxtor and Seagate all have factories here.

Apple computer has one of its two major facilities outside North America and the list goes on. While this has resulted in the development of top-class factories and a well-trained work force, it has not led to the concurrent development of a large locally generated industry.

But again, local entrepreneurs have played to their strengths. Singapore, like Hong Kong, is one of the most important commercial centers in Asia, with well developed and sophisticated shipping, banking and manufacturing sectors. It also has the level of sophistication in marketing and design like that of Hong Kong, a level largely unattained elsewhere in Asia and which fosters the development of home-grown products.

## Software

Development of software for the international market by Dragon software houses has not been the regional industry's strong suit. Which is not to say that development hasn't or doesn't occur. Most software development to date has been in for local language environments and programs. Since the international market for such software and systems is limited, so has their appeal to global players. This has left an opening that local developers have extensively



**THE SMART KEYBOARD  
REPLACEMENT.**

**NO ONE BRINGS  
OUT THE GENIUS  
IN YOU LIKE  
WE DO.**

If you put a little Genius into your computer there's no end to what you can do.

Genius *HiPen* transforms your old keyboard-based PC into a powerful pen-based system. Your handwriting will be instantly converted into type. With pad and pen. Just the way you've always worked. But with a totally new dimension of productivity.

For ultimate desktop freedom, we've created a mouse with no tail – the *HiMouse Cordless*. Its infrared beam will keep your PC in line. From up to 6 feet away.

With our new hand-held scanners, you get more hot Genius features than ever before. And intelligent software muscle you won't find anywhere else. Like precise optical character recognition and professional image processing software. So now your images and text will come out even more brilliantly than when they went in.

But without smarter input, how could anyone expect genius output?

**INTELLIGENT INPUT FOR  
BRILLIANT OUTPUT.**



**SMARTER INPUT FOR  
SMARTER OUTPUT.**

**Contact Information:**

**U.S. Technical Support Center:**

Tel.: 1-714-923-2417, Fax: 1-714-923-1469.

**U.K. Technical Support Center:**

Tel.: 44-81-680-1701, Fax: 44-81-667-0924.

**German Technical Support Center:**

Tel.: 49-6042-4085, Fax: 49-6042-69156.

**KYE Systems Corp.** No. 492, Sec. 5, Chung Hsin Rd.,  
San Chung, Taipei Hsien, 241, Taiwan, ROC.

Tel: 886-2-995-6645; Fax: 886-2-995-6649; BBS  
Modem No.: 886-2-995-0584.

**Circle 354 on Inquiry Card (RESELLERS: 355).**

**TOTAL CONTROL.  
NO STRINGS ATTACHED.**



exploited, most of all in Taiwan and South Korea. The strength of such local programming talent has led large companies like Microsoft to them when they need product localization for the Asian market. It is also seeing the beginning flex of Dragon programming muscle to produce software with more than just regional appeal.

## Design

Design, both product and industrial, has always been heavily affected by outside influences. With most of the basic technology coming originally from the U.S., and refinements and new designs coming from there and Japan, little effort has been expended on local design until recently. Product design, while still tending to express the most sincere form of flattery, has also seen a constant string of small innovations that extrapolate from the central themes to create a fugue of diversity.

By providing many more product options than might otherwise exist, Dragon PC products have contributed substantially to the wider availability of affordable PC products in all the major markets. So while design leadership is not yet in the cards, companionship is playing a big role in dispersing PC technology more broadly and affording smaller companies in the U.S. and Europe access to design options they could not produce for themselves. The importance of this, though generally unappreciated at the end of the consumer pipeline, is very tangible. This flexibility has made a major contribution to allowing and encouraging product diver-

sity in a market that might otherwise be overwhelmingly dominated by industry behemoths and their design ethos.

## Marketing

If, in this context, we're to define marketing mainly in terms of how Dragon companies have presented and promoted themselves and their own products, then marketing to date is in its beginning stages. This condition is a natural outgrowth of the fact that most production to date has been mainly at the behest of marketing-driven companies from outside the region. Things, however, have begun to change. As the global recession has seriously affected the PC industry, Dragon producers have not been immune. As their markets shrink and margins come under pressure from competition, increased costs and buyer demands, many companies are placing increasing emphasis on marketing as a way of differentiating themselves. This is particularly true in Taiwan, which has lagged farthest behind in this regard.

Most firms are concentrating on improving their marketing efforts to both attract new OEM customers and retain their existing base. For most companies in Taiwan, Hong Kong and Singapore, the expense and risk make brand creation beyond their grasp. Some, however, have taken up the challenge and in doing so are starting the Dragon PC makers on the road to becoming fully mature ventures with their own identity.

## Basic Technology

Although the basic technology

for the industry originally and for the most part still comes from elsewhere, Dragon companies have excelled at swiftly using and adapting new technology to bring products to market at a remarkable clip. In addition, increased spending on R&D in Korea and Taiwan, both private and governmental, is paying off. Korea is rapidly becoming a major source of not only mature chip technology but leading edge technology as well. And in Taiwan, the government, supported network of research institutes in cooperation with the private sector are pumping out a steady stream of Taiwan-developed components ranging from CCDs for imaging technology to CPUs and DRAM chips for systems and beyond.

Japanese components have been instrumental in the rapid development of many Dragon computer industry product sectors. Japan still possesses the technology edge that helps drive development of more complex products and in some cases serves to hinder them. While a flood of notebook computers has come out of Taiwan recently, very few of their LCD screens are made there. Taiwan manufacturers rely heavily on Japanese companies for supplies of this vital component. This situation has resulted in occasional shortages of critical components that have slowed development or delayed full product introduction. Using their traditions of finding opportunity in adversity, Taiwanese and Korean manufacturers, with some government support, are taking on the job of developing domestically produced alternatives that will eventually reduce



Quenching the world's thirst for information systems.

Over 70 countries depend on Tatung for a constant flow of technologically advanced information systems. Like state-of-the art PCs, workstations, notebooks and monitors.

And it's refreshing to know that no other manufacturer in the world offers better service and support for its distributors. Or a better quality control process. In fact, Tatung meets the stringent U.S. Military Quality Control Standard MIL-105D.



TCS-9620E MM17WAP  
TNB-700 COMPstation 40

So, if you're thirsting for a steady stream of the world's best information systems, the solution is quite clear. Tatung. It's that pure and simple





reliance on high-demand Japanese components that have limited availability.

In addition to components from Japan, there is a constant flow of technology and design from the United States to the Dragons. This is particularly true in Taiwan, which now accounts for about 15% of the PCs produced worldwide. The technology may come from the States in the form of CPUs, motherboard ASICs and BIOS code or hard disks and operating systems, but the big product rollouts by American firms are nowadays almost as likely to take place in Taipei, where the customers are, as in Silicon valley. And the trend isn't stopping there. With industry giants like Intel looking to set

up shop in Asia to fabricate even their newest technology, can the next step of Asia-generated design be all that far behind?

## PROFILES

### Taiwan

The two most obvious aspects of Taiwan's computer industry are comprehensive government support and the large number of companies involved.

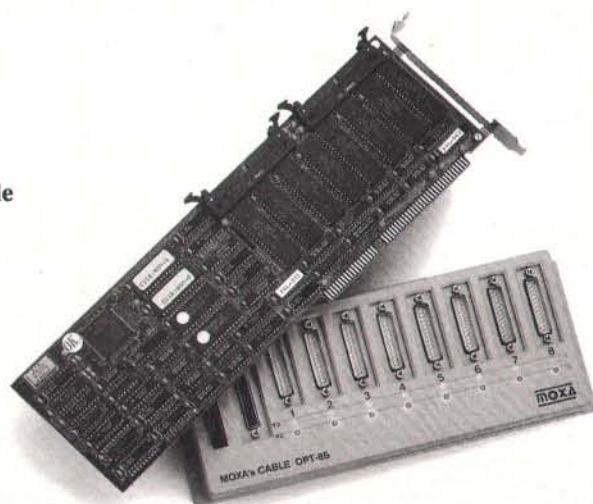
The R.O.C. government has taken a very active role in the island's economic development for decades and in recent years the information industry has been one of its top priorities. The result of these efforts has been the development of a robust, flex-

ible and highly diversified manufacturing base. The large number of companies has presented a problem for private research. Lacking the economy of scale necessary to devote significant funds for the development of the basic technology needed to produce more complex products, Taiwanese companies have had to rely on more expensive technology from outside. The Taiwan government is continuing to actively support the development of domestic alternatives that will increase Taiwan's ability to compete. Projects range from domestic production of LCD screens and the basic design work for notebook and sub-notebook products to encouraging the development of government-aided private

# INTELLIGENT 16-PORT RS-232 CARD

- INTEL 80286 CPU
- 512K memory mapped to 16K system address
- COMMUNICATION RATE: 50 to 57600 BPS programmable
- Download on board firmware
- Easy for version up-grade
- Support device drivers for UNIX/XENIX, MS-DOS
- EIA RS-232C interface: TXD, RXD, RTS, CTS, DSR, DTR, DCD, GND
- Up to 64 ports per system

For MS-DOS application, We offer a powerful software tool named MOXA API-232 Application Programming Interface for RS-232. It will help your programming and trouble-shooting.



**MOXA-C216**



**404 TECHNOLOGIES INC.**

3F, No. 266, Sec. 1, Ho Ping E. Rd., Taipei, Taiwan, R.O.C.

Tel: (886-2) 3627071

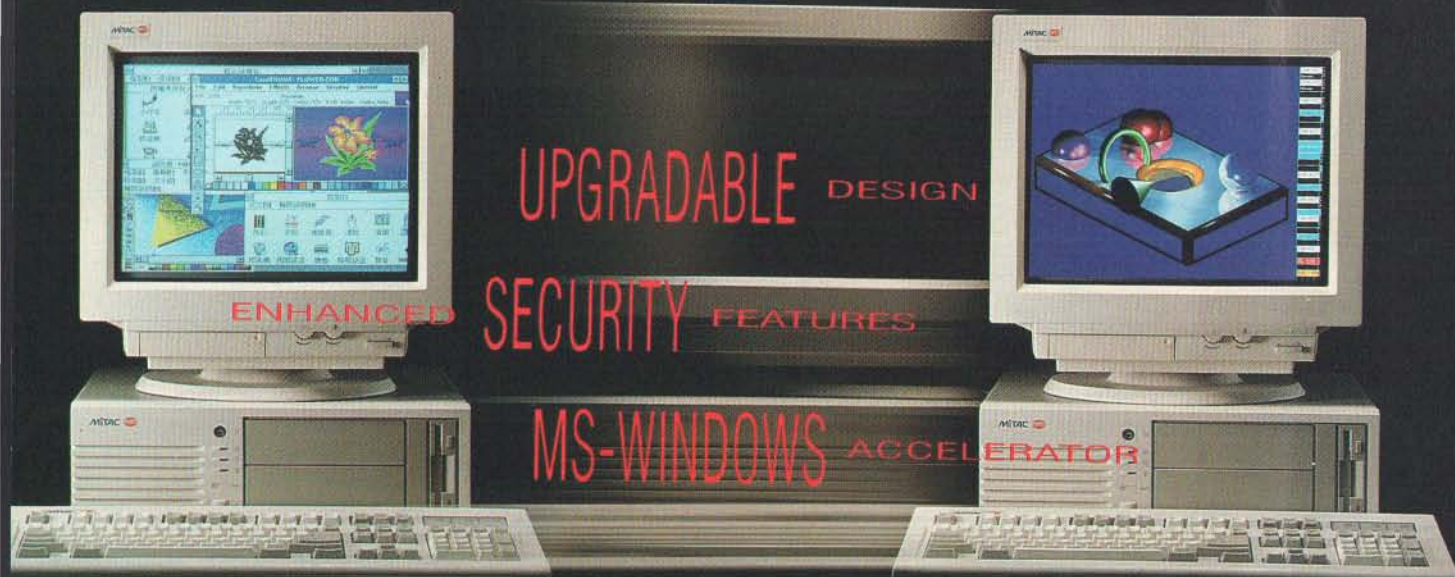
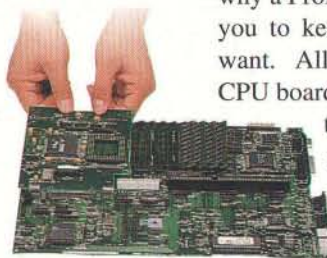
Fax: (886-2) 3631431



# Just What Makes A PC Professional?

## Upgradable Design

In a cost-conscious world, you can no longer replace your computer every two years. That's why a Professional PC, like MITAC's, allows you to keep your computer as long as you want. All you have to do is replace the old CPU board with a new one. And MITAC has the entire range of CPU boards for you to choose from—Intel® 386DX™ to 486DX-33™. So, now, you can keep your PC as long as you want.



## Enhanced Security Features

These days, buying any PC without security is asking for trouble—and especially a Professional PC. That's why, all of MITAC's PCs come with multi-layered security built-in—with password control for boot-up, keyboard lock, read and write control for floppy and hard drives, serial and parallel port access rights, as well as virus protection... in short, a complete security.



## Microsoft® Windows™ Accelerator

With MITAC's Professional PCs, you get an on-board Windows Accelerator chip. It is not an option; it comes with your PC to speed up your Windows applications as many as seven or eight times.



Circle 341 on Inquiry Card (RESELLERS: 342).



MITAC (UK) LTD. Unit 12, Hortonwood 32 Telford, Shropshire TF1 4EX England TEL: (0952) 670370-4 FAX: (0952) 605605 ■ MITAC GmbH Technorama/Obenbaumer Weg 6, 4000 Düsseldorf 30 Germany TEL: 0211-41-2086, 7 FAX: 0211-41-2080 ■ AMERICAN MITAC CORP. 410 East Plumeria Dr., San Jose, CA 95134 TEL: (800) MITC-U.S. (408) 432-1160 FAX: (408) 432-0866 ■ MITAC JAPAN CORP. 5-7-14, Kita-Shinagawa, Shinagawa-Ku, Tokyo 141, Japan TEL: 03-5420-02 FAX: 03-5420-4586 ■ MITAC AUSTRALASIA PTY LTD. No. 353 Warrigal Rd., Cheltenham, VIC 3192, Australia TEL: 61-3-585-1055 FAX: 61-3-585-1596 ■ MITAC PACIFIC (H.K.) LTD. Rm. 502, Shiu Lam Building, 23 Luard Rd., Wanchai, H.K. TEL: 852-528-6782 FAX: 852-861-3754 ■ MITAC EUROPEAN DISTRIBUTION OFFICE Unit 12, Hortonwood 32 Telford, Shropshire TF1 4EX England TEL: 952-670370 FAX: 952-676028 ■ MITAC INTERNATIONAL CORP. 8th Fl., No. 75 Ming Sheng E. Rd., Sec. 3, Taipei, Taiwan, R.O.C. TEL: 886-2-501-8231 FAX: 886-2-501-4265

Intel is a registered trademark and 386DX and 486DX-33 are trademarks of Intel Corporation. MITAC is a registered trademark of MITAC International Corporation. The Intel Inside logo is a trademark of Intel Corporation. Microsoft Windows is a registered trademark of Microsoft Corporation.

MITAC has all what you need



People Committed To InfoTech

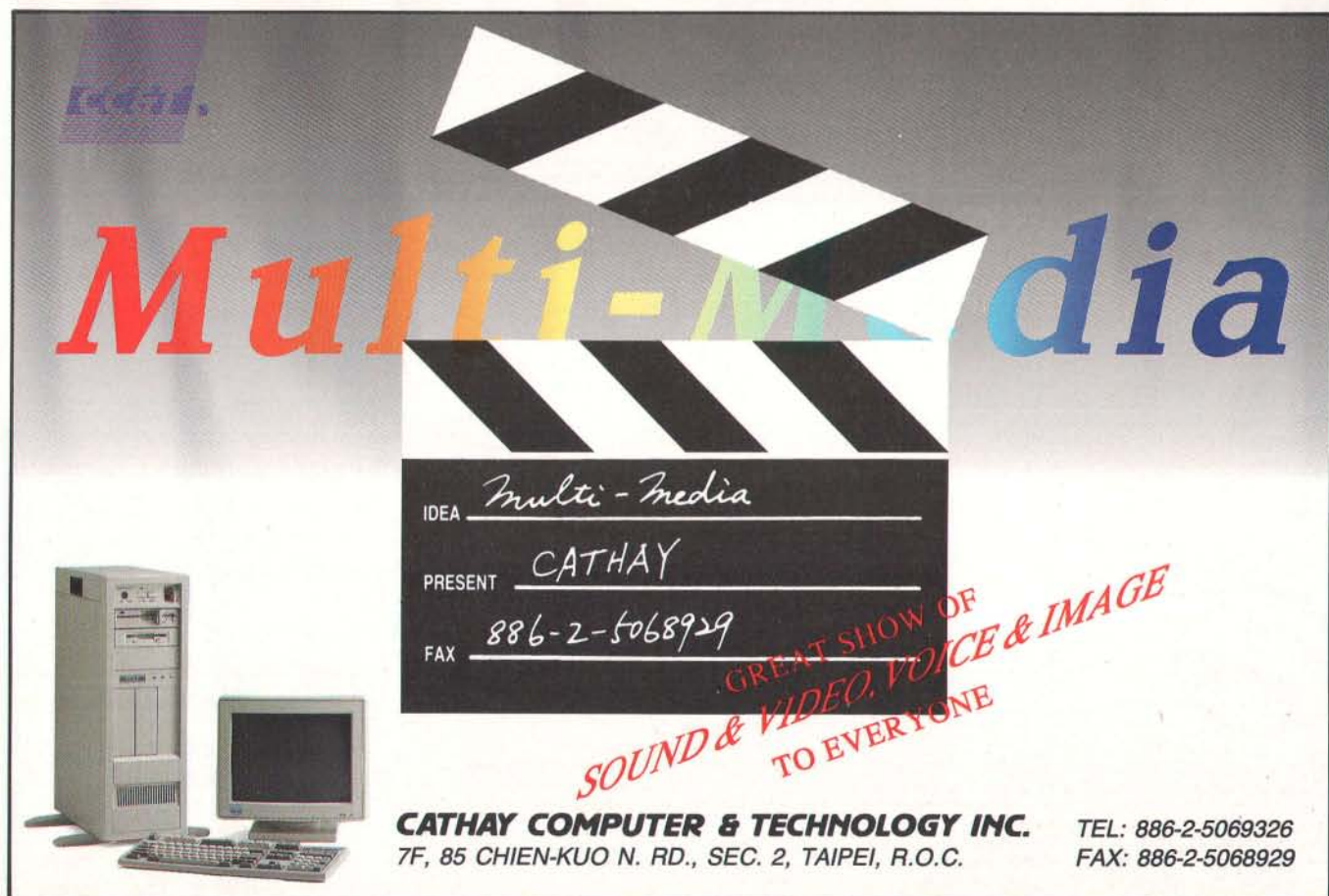


consortia that will build DRAM fabs and other chip-level production facilities to produce local designs. The government maintains this constant flow of support mainly via organizations set up for the purpose. The Electronic Research and Service Organization (ERSO), a part of the Industrial Technology Research Institute (ITRI), spearheads research projects, providing the lion's share of financing, doing the development and then transferring the results to interested manufacturers. With a research budget larger than the yearly proceeds of some of the companies it supports, ERSO provides a technological edge many or most could not aspire to on their own.

The Institute for Information Industry (III) supports Taiwan's exporters on the software front. With far less private sector resources devoted to software development, "Triple-I" has provided an important boost in this area and continues to act as a training ground for engineers who subsequently make their way into private firms. Like ERSO, it too transfers technology and sometimes complete applications to bolster particular hardware technologies such as image processing.

In addition to the ERSO and III, the Taiwan government in 1980 created a corporate research park south of Taipei to focus and develop the high-end research efforts. The 1000-acre

campus of the Hsin Chu Science Park houses a mix of foreign and domestic companies that concentrate mainly on the research and development of electronics products including computer, semiconductor and communications technology. From humble beginnings the park has grown to become a technology dynamo with an annual output now measured in billions of dollars and a place as the technology leader for the island's industry. The number of companies in Taiwan's PC industry relative to its productive output is enormous, with a large number of them unknown even to the legions of foreign buyers who frequent the island. This is because Taiwan's manufacturing is so dispersed that in many cases



**Multi-Media**

IDEA *Multi-Media*

PRESENT *CATHAY*

FAX *886-2-5068929*

*GREAT SHOW OF  
SOUND & VIDEO, VOICE & IMAGE  
TO EVERYONE*

**CATHAY COMPUTER & TECHNOLOGY INC.**  
7F, 85 CHIEN-KUO N. RD., SEC. 2, TAIPEI, R.O.C.

TEL: 886-2-5069326  
FAX: 886-2-5068929

The advertisement features a large clapperboard with the word "Multi-Media" in a stylized, multi-colored font. Below the clapperboard, there is a photograph of a vintage computer system, including a tower unit, a monitor, and a keyboard. The clapperboard itself has handwritten text for "IDEA", "PRESENT", and "FAX". A red, angled banner with white text is positioned over the bottom right of the clapperboard.



SHIPPED FROM  
HAWAII WITH DUTY EXEMPT!



Powerful, Upgradeable, Flexible, Portable, Reliable....



**AUTOCOMPUTER CO., LTD.**

NO. 18, Pei Yuan Road, Chung-Li City, Tao-Yuan Hsien, Taiwan, R.O.C.  
Tel: (03) 452-8200 Fax: (03) 452-9155, 452-5931 Telex: 31271

**AUVA COMPUTER CO., LTD., THAILAND**  
Bangrak Industrial Estate(3), No. 381 Chalokkrung Rd.,  
Bang Lamphu, Ladkrabang, Bangkok 10520, Thailand.  
TEL: 66-2-3260455~8 FAX: 66-2-3260459

**AUVA COMPUTER INC. CA., USA**  
51 Knott Ave., Suite B, La Mirada, Ca. 90638, USA.  
(714) 5626988 FAX: (714) 5626980

**COMPUTER INC. CA., USA**  
51, Knott Ave., Suite A, La Mirada, Ca. 90638, USA.  
(714) 5626999 FAX: (714) 5626990

**VIP COMPUTER INC. IL., USA**  
960 Industrial Dr., #7, Elmhurst, IL 60126, USA.  
TEL: (708) 8323080 FAX: (708) 8322858  
**APEX COMPUTER GmbH. D'DORF., GERMANY**  
Schies Str. 46, 4000 Duesseldorf 11, West Germany.  
TEL: (211) 596737 FAX: (211) 594317  
**APEX COMPUTER GmbH. BERLIN, GERMANY**  
Buckower Chaussee 69-70, 1000 Berlin 48, West Germany.  
TEL: (030) 724021~4 FAX: (030) 727046  
**AUVA COMPUTER GmbH. WIEN., AUSTRIA**  
Margaretenquertel 12, A-1050 Wien, Austria.  
TEL: (431) 5454251/9 FAX: (431) 5454266

**AUVA COMPUTER SRL. CILAVENGNA, ITALY**  
VIA Gravelona, 45, 27024 Cilavegna (Pavia), Italy.  
TEL: (39381) 969781 FAX: (39381) 969784

**AUVA COMPUTER B.V. ROTTERDAM, HOLLAND**  
Klompemakerstraat 18B, 2984 BB Ridderkerk, Netherlands, Holland.  
TEL: (1804) 10911 FAX: (1804) 14840

**AUVA COMPUTER AUSTRALIA PTY., LTD., SYDNEY, AUS.**  
Unit 26, No. 9, CNR, Salisbury Rd. & Hudson Ave., Caste Hill 2154,  
N.S.W., Australia.  
TEL: (612) 8997176 FAX: (612) 8997187

Circle 362 on Inquiry Card (RESELLERS: 363).



companies "manufacture" only a small minority of their total product, the rest coming from largely unseen and unnamed contract factories upstream that produce all manner of components or even portions of components. This degree of "horizontality," while affording great financial flexibility to Taiwanese manufacturers, can also sometimes result in reliability and deliverability problems which hinder smaller companies. It also makes a large number of behind-the-scenes companies dependent on the front-line companies selling the finished product.

As the labor shortage and rising cost of labor on Taiwan have squeezed both these upstream companies and larger, more verti-

cally integrated ones, recent developments are seeing a rapid shift of manufacturing facilities to the special economic zones on the China mainland as well as investment in Thailand, Malaysia, Indonesia, Viet Nam and the Philippines. This is in line with the government's main economic goal of reducing Taiwan's dependence on labor-intensive industries and promoting high-technology, high value-added ones.

### Korea

The structure of the industry in South Korea is almost the opposite of Taiwan's. Being controlled mainly by large industrial conglomerates has engendered the creation of large, well-capitalized firms with major investments

in production and research facilities. Government involvement like that seen in Taiwan is mostly absent. But while these firms have the size and money to pursue large, long-term and expensive projects, they are not able to respond as quickly to market developments. They do, however, have mass production capacity and economies of scale that make them an attractive option for large OEM customers. Smaller Korean companies are relatively few in number and do not have much influence on industry trends.

Over the last year or so the Korean's overall share of the PC market sector has dropped, inducing the large companies to move in two main directions

# THAT'S V.32bis FAX/DATA MODEM

## STAND ALONE

- \* HIGH SPEED COMPATIBILITY WITH V.32 bis V.42 bis AND CLASS I, II G3 9600bps S/R FAX
- \* ELEGANT DESIGN IN COMPACT LIGHTWEIGHT SIZE
  - \* DIMENSIONS: 150 X 120 X 30mm
  - \* WEIGHT: 200 grams
- \* 9 OR 25 PIN D CONNECTOR OUTPUT TO PC'S RS-232 SERIAL PORT
- \* SUPPORT COMMUNICATION SOFTWARE FOR DOS WINDOWS
- \* PATENTED DESIGN No.31626



**PORA**

PORA CORPORATION  
4/F, 196 Cheng Teh Road, 4 Sec  
Taipei, Taiwan, R.O.C.  
Tel: 886-2-8835579  
Fax: 886-2-8835582



**COMDEX/ Fall '92**

16-21 November, 1992  
Las Vegas, Nevada, U.S.A.

BOOTH No.S1642B



## POCKET:

- \* RELIABLE ERROR FREE CONNECTIVITY V.42 V.42bis MNP2-5 AND V.23 PROTOCOL, WITH CLASS II G3 9600bps S/R FAX
- \* 90° POSITION ADJUSTABLE RS-232 9 PIN D CONNECTOR
- \* PATENTED LOCKING THUMBSCREW DIRECT CONNECTION TO SERIAL PORT
- \* DC 9V OPERATION WITH BATTERY AND EXTERNAL AC/DC ADAPTER
- \* INTELLIGENT POWER SAVING CIRCUIT
- \* REMOVABLE COVER TO PROTECT CONNECTOR AND KEEP IT DUST-FREE
- \* DIMENSION: 154 X 60 X 30mm WEIGHT: 170 grams (WITH COVER AND BATTERY)



# The desktop for people with no desks!



In these days of laptops, notebooks and palmtops, the very mention of a desktop is likely to turn people off. After all, who needs a great big machine when you can get the same performance from a much smaller package? We couldn't agree more.

That's why we came up with the DIGIlight. It offers all the power of a desktop plus the convenience of a notebook. The DIGIlight is designed for practical people who need plenty of work space plus the flexibility to move around.

The DIGIlight can be easily relocated so the user can plug in his favorite monitor and keyboard, then get down to work with all the power needed to get the job done. And wherever it is, there will be no shortage of desk space!

ITEM	DL-386SX/25	DL-386DX/33	DL-486DX/33/50 DL-486SX/20/25
CPU	386SX-25MHz	386DX-33MHz	486DX-33/50MHz
COPROCESSOR	80387SX	387 OR Weitek	486SX-20/25 MHz
VGA	512K, 1024 x 768, 16 color		
MEMORY	1/2/4/6/8MB	1/4/16MB	1/4/16MB
CACHE SIZE	None	32K/128K Cache	32K/128K Cache
I/O PORTS	2S/1P	2S/1P	2S/1P
POWER	Power Adapter	Internal Power	Internal Power
DIMENSION	240mm x 195mm x 45mm	315mm x 225mm x 70mm	
WEIGHT	2.6 KGS	3 KGS	



ASIA:  
**DIGICOM INC.**  
9FL, NO. 2, LANE 235,  
PAO-CHIAO ROAD  
HSIN-TIEN CITY, TAIPEI COUNTY  
TAIWAN R.O.C.  
FAX: 886-2-918-6277  
TELEX: 35262DIGICOM  
TEL: 886-2-918-6077

EUROPE:  
**DIGICOM  
EUROPE B.V.**  
RIDDERPOORT 4,  
2984 BG RIDDERKERK  
THE NETHERLANDS  
FAX: 31-1804-19815  
TEL: 31-1804-11888

U.S.A.  
**AMERICAN  
DIGICOM CORP.**  
CALIFORNIA OFFICE:  
1233 MIDAS WAY  
SUNNYVALE,  
CA 94086 U.S.A.  
FAX: 408-245-1584  
TEL: 408-245-1580

NEW YORK OFFICE:  
125 MICHAEL DRIVE  
SUITE 103 SYOSSET,  
NY 11791 U.S.A.  
FAX: 516-496-2366  
TEL: 516-496-2323

TEXAS OFFICE:  
1701 GREENVILLE AVE,  
SUITE 207 RICHARDSON,  
TEXAS 75081 U.S.A.  
FAX: 214-480-0199  
TEL: 214-480-9998

Circle 350 on Inquiry Card (RESELLERS: 351).



while they work on additional plans to win back and increase their share. Several companies are augmenting their efforts to create or expand their own brands with some degree of success. With better funding and more reliance on international expertise than seen elsewhere, Korean system and peripheral manufacturers are making rapid progress in defining themselves and creating brand awareness. At the same time, on-going investments in semiconductor research and fabrication are being sustained or increased along with new collaborative agreements which will further enlarge this important sector of the Korean industry.

### Singapore

Singapore's computer industry is also dominated by large companies, but in its case the companies are the local subsidiaries of American and European and even Japanese firms. Singapore's well-developed infrastructure, highly-trained work force and political stability have proven so attractive to them that Singapore enjoys the largest concentration of high-end factories in the region. Systems and components are manufactured here both for regional consumption and export back to the home markets, often as part of products from Dragon manufacturers.

The Singapore industry, with government encouragement, is also rapidly expanding investment in semiconductor fabrication to a degree that it may become another production center in the next few years.

On the other side, while there are relatively fewer small firms

compared to elsewhere, a keen understanding of how to use marketing skill in place of size has several local companies developing or already marketing peripheral and niche products that both produce higher profit and are less subject to the cutthroat competition faced by makers of mass-market products.

### Hong Kong

Hong Kong, while having the smallest industry of the four, is poised to play a seminal role in the possible development of a greater Chinese enterprise that may see the combination of Hong Kong, Taiwan and mainland China's industries in a not-so-loose federation that will make use of the strengths of each. Standing as the main point of communication and transshipment between the PRC and Taiwan, Hong Kong's industry already has a well developed base of companies and engineers making a full range of products for OEM customers. With solid connections in both Taiwan and the Mainland, Hong Kong's is already facilitating the swift expansion of Taiwanese manufacturing investment in South China. This is especially true just over the border in Hong Kong's Cantonese-speaking alter ego, Shenzhen. Such investment can only be expected to increase as pressure at the other end of the pipeline in Taiwan continues to mount. Many firms are already looking to mainland facilities to give them a competitive edge. It is a distinct possibility that the next five to ten years will see Taiwan's technological prowess, Hong Kong's marketing skills, transportation links and

financial acumen along with the mainland's productive capacity coalesce into a regional collaboration. A collaboration that, potential political limitations notwithstanding, could produce a force that will have significant impact on the global market.

### CONCLUSION

All four dragons are thriving in the fertile economic conditions that continue to exist in Asia. Although squeezed by the recession in the industrialized countries and a largely flat market industry-wide, their information technology companies continue to enjoy the flexibility afforded them by relentlessly burgeoning growth at home, active government support and the continuing benefits of investment by and technology transfer from companies that are the technological driving force of the industry world-wide. While not yet ready to assume a position of leadership, the time is not far off when they will, as part of a greater Asia-region industry, come into their own and assume a position as full partners in the industry of the 21st century.



# Taiwan Resource Guide

**404 TECHNOLOGIES INC.**  
FL3,NO.266,SEC.1, Ho Ping E.RD.,  
Taipei,Taiwan R.O.C.

TEL:886-2-3627071  
FAX:886-2-3631431

**MITAC INTERNATIONAL CORP.**  
8th Fl.,NO.75,Ming Sheng E Rd.,Sec.3,  
Taipei,Taiwan,R.O.C.

TEL:886-2-5018231  
FAX:886-2-5014265

**AXIOM TECHNOLOGY CO.,LTD.**  
3Fl.,No.12,Alley 59,Lane 42,Ming Chuan  
Rd., Shing Tien  
City,Taipei,Taiwan,R.O.C.

TEL:886-2-9174550  
FAX:886-2-9173200

**ZECKS ENTERPRISE CO.,LTD.**  
7th Fl.-1,3 Wu Chuan 1st  
Rd.,Hsinchuang, Taipei,Taiwan,R.O.C.

TEL:886-2-2992022  
FAX:886-2-2992027

**ULTIMA ELECTRONICS CORP.**  
9F,No.18,Alley 1,Lane 768,Sec.4,Pa Te  
Rd., Taipei,Taiwan,R.O.C.

TEL:886-2-7885470  
FAX:886-2-7885657

**TECHPOWER CO., LTD.**  
20th Fl., No. 1058, Minsheng E. Rd.,  
Taipei, Taiwan, R.O.C.

TEL:886-2-7531930  
FAX:886-2-7531940

**TWINHEAD INTERNATIONAL  
CORP**

Grobal Industrial Center,2F,2 Lane  
235,Bao Chiao Rd., Hsin Tien,  
Taiwan,R.O.C.

TEL:886-2-9179036  
FAX:886-2-9172675

**TATUNG CO.**

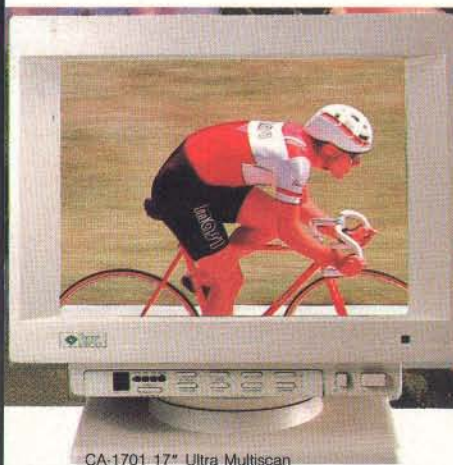
22 Chungshan N.Rd.,3rd Sec.,  
Taipei,Taiwan,104,R.O.C.

TEL:886-2-5925252  
FAX:886-2-5915185

**KUO FENG CORPORATION**

Suite 602,136 Jen-Ai Rd.,Sec 3,  
Taipei,Taiwan,R.O.C.

TEL:886-2-7548353  
FAX:886-2-7548498



CA-1701-17" Ultra Multiscan



## KFC MONITORS More Than You Expect...

**KFC USA, INC.**  
1585 SUNLAND LANE,  
COSTA MESA,  
CA 92626 U.S.A.  
TEL: 714-546-0336  
FAX: 714-546-0315

**COMDEX/Fall '92**  
16-21 November, 1992  
Las Vegas, Nevada, U.S.A.  
SAND'S EXPO CONVENTION CENTER  
BOOTH NO. S4046E

- \* **Low Radiation**
- \* **Non-interlaced**



With KFC, you need not sacrifice performance and comfort to safety.

KFC has been in the monitor industry for eight years. During this time, we have designed and produced monitors for the world's most critical OEM customers and distributors.

We offer a full line of high-performance monitors. Come to KFC and you will get products of a quality you can always count on!

	14" Color				15" Color	17" Color
Model/Spec. Description	CK-1420 (38K)	CK-1420N (48K)	CM-1410	CM-1413	CA-15	CA-1701
	VGA Multiscan	VGA Multiscan	Multiscan	Multiscan	Multiscan	Multiscan
H. Freq.	30-38 KHz	30-48 KHz	30-50KHz	30-60KHz	30-66KHz	30-75KHz
Dot Pitch	.28mm	.28mm	.28mm	.28mm	.28mm	.28mm
Resolution	1024 x 768	1024 x 768	1024 x 768	1024 x 768	1024 x 768	1280 x 1024

\*MB-0931 Mono VGA & MA-0931 9" Mono Monitors are also available.



**Kuo Feng Corporation**

Head Office:  
Suite 602, 136 Jen-Ai Rd., Sec. 3 Taipei, Taiwan, R.O.C.  
TEL: (886) 2 754-8353 FAX: (886) 2 754-8498

Specifications are subject to change without notice. All trademarks and registered trademarks are the property of their respective companies.



**ADDA TECHNOLOGIES INC.**

No. 28-1, Lane 191, Yung Ho Rd., Jong Ho County, Taipei, Taiwan, R.O.C.

TEL: 886-2-2484131

FAX: 886-2-2484276

**CATHAY COMPUTER & TECHNOLOGY INC.**

7F., 85 Chien Kuo N. Rd., Sec 2, Taipei, Taiwan, R.O.C.

TEL: 886-2-5069326

FAX: 886-2-5068929

**UNITED HITECH CORP.**

7F-1, No. 1, Wu Chuan 1 Rd., Hsin Chung City, Taipei, Taiwan, R.O.C.

TEL: 886-2-2993125

FAX: 886-2-2993210

**DIGICOM INC.**

9th Fl., No. 2, Lane 235, Pao Chiao Rd., Hsin Tien City, Taiwan, R.O.C.

TEL: 886-2-9186077

FAX: 886-2-9186277

**PORA CORPORATION**

4/F, 196 Cheng Teh Rd., Sec 4, Taipei, Taiwan, R.O.C.

TEL: 886-2-8835579

FAX: 886-2-8835582

**YUAN TECHNOLOGY U.S.A.**

1223, S. Dorsey Ln #203, Tempe, AZ 85281 U.S.A.

TEL: 602-9661557

FAX: 602-9661671

**AUTOCOMPUTER CO., LTD.**

No. 18, Pei Yuan Rd., Chung Li, Industrial Park, Tao Yuan District.

TEL: 886-3-4528200

FAX: 886-3-4525931

**ROYAL INFORMATION ELECTRONICS CO.,**

LTD. 9F., No. 85, Chung Hsiao E Rd., Sec. 1, Taipei, Taiwan, R.O.C.

TEL: 886-2-3211369

FAX: 886-2-3961011

**KUN YING ENTERPRISE CO LTD.,**

No. 492, Sec 5, Chung Hsin Rd., San Chung, Taiwan, R.O.C.

TEL: 886-2-9956645

FAX: 886-2-9956649

**HI-PERFORMANCE · LOW NOISE SWITCHING POWER SUPPLY  
PRECISE · LATEST DESIGN COMPUTER CASE**



R94487



E144272



LR98205



9226180



A94055



155001



**ZKS-730T (ZKS-730M)**  
(212x150x150MM)

**ZKS-520T (ZKS-520M)**  
(150x140x85MM)



See us at:

**SCANCOM 92**  
6-7 October, 1992  
Gothenburg, Sweden

**ZKS-910T**  
(175x105x55MM)

**ZKS-500T**  
(152x140x72MM)

**ZECK**

SALES

**ZECKS ENTERPRISE CO., LTD.**  
6F, NO. 111-32, SEC 4, SAN HO RD., SAN CHUANG CITY, TAIPEI, TAIWAN, R.O.C.  
FAX: 886-2-2801351

**SWITCHING POWER SUPPLY**

\*\*OPTIONAL FAN CONTROLLED CARD (FAN REGULATOR) IS AVAILABLE FOR YEARS. IT PROVIDES YOU A NOISE SOLUTION

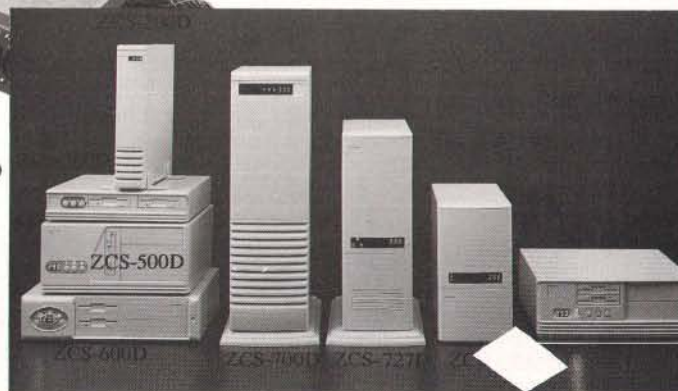
\*\*ALL POWER SUPPLIES COMPLY WITH SAFETY STANDARDS-UL, CSA, TUV, DEMKO, SEMKO, NEMKO, FEMKO

**COMPUTER CASE**

\*\*A COMPLETE RANGE OF COMPUTER CASE INCLUDING SLIM LINE CASE, DESK-TOP CASE, MINI-TOWER, MIDDLE-TOWER AND TOWER CASE.

\*\*3-DIGIT DISPLAY

\*\*BLACK, WHITE COLOR





# Next-Generation Operating-System Applications

A representative sampling of software companies that have announced support for IBM's OS/2 2.0, Univel's UnixWare, or Microsoft's Windows NT.

## OS/2 2.0

**Abraxas Software**  
(503) 244-5253  
fax: (503) 244-8375  
**Circle 1183 on Inquiry Card.**

**Adobe Systems, Inc.**  
(415) 961-4400  
fax: (415) 961-3769  
**Circle 1184 on Inquiry Card.**

**Banyan Systems, Inc.**  
(508) 898-1000  
fax: (508) 898-1755  
**Circle 1185 on Inquiry Card.**

**Borland International, Inc.**  
(800) 331-0877  
(408) 438-8400  
fax: (408) 439-9344  
**Circle 1186 on Inquiry Card.**

**DeScribe, Inc.**  
(800) 448-1586  
(916) 646-1111  
fax: (916) 923-3447  
**Circle 1187 on Inquiry Card.**

**Enfin Software Corp.**  
(800) 922-4372  
(619) 549-6606  
fax: (619) 549-6798  
**Circle 1188 on Inquiry Card.**

**Imara Research Corp.**  
(416) 581-1740  
fax: (416) 581-1605  
**Circle 1189 on Inquiry Card.**

**Lucas Management Systems**  
(800) 477-6648  
(703) 222-1111  
fax: (703) 222-8203  
**Circle 1190 on Inquiry Card.**

**Microsoft Corp.**  
(800) 426-9400  
(206) 882-8080  
fax: (206) 936-7329  
**Circle 1191 on Inquiry Card.**

**MicroWay, Inc.**  
(508) 746-7341  
fax: (508) 746-4678  
**Circle 1192 on Inquiry Card.**

**Novell, Inc.**  
(800) 453-1267  
(801) 429-7000  
fax: (801) 429-5775  
**Circle 1193 on Inquiry Card.**

**Oracle Corp.**  
(800) 672-2531  
(415) 506-7000  
fax: (415) 506-7200  
**Circle 1194 on Inquiry Card.**

**Project Management, Inc.**  
(301) 469-9001  
fax: (301) 365-5139  
**Circle 1195 on Inquiry Card.**

**Quantum Development Corp.**  
(302) 798-0899  
fax: (302) 798-6813  
**Circle 1196 on Inquiry Card.**

**Rainbow Technologies, Inc.**  
(714) 454-9899  
fax: (714) 454-8557  
**Circle 1197 on Inquiry Card.**

**Revelation Technologies, Inc.**  
(800) 262-4747  
(203) 973-1000  
fax: (203) 975-8744  
**Circle 1198 on Inquiry Card.**

**Softronic, Inc.**  
(800) 225-8590  
(719) 593-9540  
fax: (719) 548-1878  
**Circle 1199 on Inquiry Card.**

**Star-Tek, Inc.**  
(800) 225-8528  
(508) 393-9393  
fax: (508) 393-6934  
**Circle 1200 on Inquiry Card.**

**Sybase, Inc.**  
(800) 879-2273  
(510) 596-3500  
fax: (510) 658-9441  
**Circle 1201 on Inquiry Card.**

**Vienna Software**  
(407) 241-5902  
fax: (407) 241-5754  
**Circle 1202 on Inquiry Card.**

**Watcom**  
(800) 265-4555  
(519) 886-3700  
fax: (519) 747-4971  
**Circle 1203 on Inquiry Card.**

**ZSoft Corp.**  
(800) 444-4780  
(404) 428-0008  
fax: (404) 427-1150  
**Circle 1204 on Inquiry Card.**

## UNIXWARE

**Absoft Corp.**  
(313) 853-0050  
fax: (313) 853-0108  
**Circle 1205 on Inquiry Card.**

**Acucobol, Inc.**  
(800) 262-6585  
(619) 689-7220  
fax: (619) 566-3071  
**Circle 1206 on Inquiry Card.**

**Always Technology Corp.**  
(818) 597-1400  
fax: (818) 597-1496  
**Circle 1207 on Inquiry Card.**

**Applix, Inc.**  
(800) 827-8379  
(508) 870-0300  
fax: (508) 366-9313  
**Circle 1208 on Inquiry Card.**

**Cadre Technologies, Inc.**  
(401) 351-2273  
fax: (401) 455-2376  
**Circle 1209 on Inquiry Card.**

**Clarity Software, Inc.**  
(800) 235-6736  
(415) 691-0320  
fax: (415) 964-4383  
**Circle 1210 on Inquiry Card.**

**Cleo Communications**  
(800) 233-2536  
(313) 662-2002  
fax: (313) 662-1965  
**Circle 1211 on Inquiry Card.**

**Control Corp.**  
(612) 631-7654  
fax: (612) 631-8117  
**Circle 1212 on Inquiry Card.**

**Digital Tools, Inc.**  
(408) 366-6920  
fax: (408) 446-2140  
**Circle 1213 on Inquiry Card.**

**Enhanced Software Technologies**  
(602) 820-0042  
fax: (602) 491-0865  
**Circle 1214 on Inquiry Card.**

**Frame Technology Corp.**  
(800) 843-7263  
(408) 433-3311  
fax: (408) 433-1928  
**Circle 1215 on Inquiry Card.**

**Great Plains Software**  
(800) 456-0025  
(701) 281-0550  
fax: (701) 281-3328  
**Circle 1216 on Inquiry Card.**

**Gupta Technologies**  
(800) 876-3267  
(415) 321-9500  
fax: (415) 321-5471  
**Circle 1217 on Inquiry Card.**

**Hyperdesk Corp.**  
(508) 366-5050  
fax: (508) 898-3841  
**Circle 1218 on Inquiry Card.**

**Infopro, Inc.**  
(708) 571-4636  
fax: (708) 571-1044  
**Circle 1219 on Inquiry Card.**

**Information Builders, Inc.**  
(800) 969-4636  
(212) 736-4433  
fax: (212) 564-1881  
**Circle 1220 on Inquiry Card.**

**Informix Software, Inc.**  
(800) 438-7627  
(415) 926-6300  
fax: (415) 926-6593  
**Circle 1000 on Inquiry Card.**

**Ingres Corp.**  
(800) 446-4737  
(510) 769-1400  
fax: (510) 748-3618  
**Circle 1001 on Inquiry Card.**

**Integrated Computer Solutions, Inc.**  
(617) 621-0060  
fax: (617) 621-9555  
**Circle 1002 on Inquiry Card.**

**Island Graphics Corp.**  
(800) 255-4499  
(415) 491-1000  
fax: (415) 491-0402  
**Circle 1003 on Inquiry Card.**

**Legato Systems, Inc.**  
(415) 329-7880  
fax: (415) 329-8898  
**Circle 1004 on Inquiry Card.**

**Liant Software Corp.**  
(800) 662-9866  
(508) 872-8700  
fax: (508) 626-2221  
**Circle 1005 on Inquiry Card.**



**Lotus Development Corp.**  
(800) 343-5414  
(617) 577-8500  
fax: (617) 693-1197  
**Circle 1006 on Inquiry Card.**

**Microfield Graphics**  
(503) 626-9393  
fax: (503) 641-9333  
**Circle 1007 on Inquiry Card.**

**NetLabs, Inc.**  
(415) 961-9500  
fax: (415) 961-9300  
**Circle 1008 on Inquiry Card.**

**Neuron Data, Inc.**  
(800) 876-4900  
(415) 321-4488  
fax: (415) 321-3728  
**Circle 1009 on Inquiry Card.**

**Object Design, Inc.**  
(617) 270-9797  
fax: (617) 270-3509  
**Circle 1010 on Inquiry Card.**

**Oracle Corp.**

**Progress Software Corp.**  
(800) 327-8445  
(617) 275-4500  
fax: (617) 280-4095  
**Circle 1011 on Inquiry Card.**

**Raima, Inc.**  
(800) 327-2462  
(206) 747-5570  
fax: (206) 747-1991  
**Circle 1012 on Inquiry Card.**

**Software AG**  
(703) 860-5050  
fax: (703) 391-6975  
**Circle 1013 on Inquiry Card.**

**Softworks, Inc.**  
(800) 638-9254  
(301) 856-1892  
fax: (301) 868-6740  
**Circle 1014 on Inquiry Card.**

**Thoroughbred Software International, Inc.**  
(800) 524-0430  
(908) 560-1377  
fax: (908) 560-1594  
**Circle 1015 on Inquiry Card.**

**Unify Corp.**  
(800) 248-6439  
(916) 928-6400  
fax: (916) 928-6401  
**Circle 1016 on Inquiry Card.**

**Voxem, Inc.**  
(908) 576-1566  
fax: (908) 576-1567  
**Circle 1017 on Inquiry Card.**

**WordPerfect Corp.**  
(800) 451-5151  
(801) 225-5000  
fax: (801) 228-5077  
**Circle 1018 on Inquiry Card.**

**Xtree Co.**  
(800) 964-2490  
(805) 541-0604  
fax: (805) 541-8053  
**Circle 1019 on Inquiry Card.**

## WINDOWS NT

**Amish Software, Inc.**  
(415) 323-4627  
fax: (415) 323-0138  
**Circle 1020 on Inquiry Card.**

**Arbor Software Corp.**  
(800) 858-1666  
(408) 727-7166  
fax: (408) 727-7140  
**Circle 1021 on Inquiry Card.**

**Autodesk, Inc.**  
(800) 445-5415  
(415) 332-2344  
fax: (415) 331-8093  
**Circle 1022 on Inquiry Card.**

**Automated Methods, Inc.**  
(800) 231-4086  
(415) 750-1975  
fax: (415) 750-9867  
**Circle 1023 on Inquiry Card.**

**Computervision**  
(800) 488-7228  
(617) 275-1800  
fax: (617) 275-0529  
**Circle 1024 on Inquiry Card.**

**Corel Systems Corp.**  
(800) 836-3729  
(613) 728-8200  
fax: (613) 728-2891  
**Circle 1025 on Inquiry Card.**

**Coromandel Industries, Inc.**  
(800) 535-3267  
(718) 793-7966  
fax: (718) 793-9710  
**Circle 1026 on Inquiry Card.**

**Crystal Point, Inc.**  
(206) 487-3656  
fax: (206) 487-3773  
**Circle 1027 on Inquiry Card.**

**Data Access Corp.**  
(800) 451-3539  
(305) 238-0012  
fax: (305) 238-0017  
**Circle 1028 on Inquiry Card.**

**Digital Equipment Corp.**  
(508) 493-5111  
fax: (508) 493-8780  
**Circle 1029 on Inquiry Card.**

**Easel Corp.**  
(617) 221-2100  
fax: (617) 221-3099  
**Circle 1030 on Inquiry Card.**

**FileNet Corp.**  
(714) 966-3400  
fax: (714) 966-3490  
**Circle 1031 on Inquiry Card.**

**Frame Technology Corp.**

**FranklinQuest, Inc.**  
(800) 877-1814  
(801) 975-9992  
fax: (801) 975-9995  
**Circle 1032 on Inquiry Card.**

**Future Soft Engineering, Inc.**  
(713) 496-9400  
fax: (713) 496-1090  
**Circle 1033 on Inquiry Card.**

**Guild Products, Inc.**  
(415) 593-3200  
fax: (415) 595-8158  
**Circle 1034 on Inquiry Card.**

**Hamilton Laboratories**  
(508) 358-5715  
fax: (508) 358-1113  
**Circle 1035 on Inquiry Card.**

**Hilgraeve, Inc.**  
(800) 826-2760  
(313) 243-0576  
fax: (313) 243-0645  
**Circle 1036 on Inquiry Card.**

**Horizon Technology, Inc.**  
(619) 292-8320  
fax: (619) 565-1175  
**Circle 1037 on Inquiry Card.**

**Image-In, Inc.**  
(800) 345-3540  
(612) 888-3633  
fax: (612) 888-3665  
**Circle 1038 on Inquiry Card.**

**Inference Corp.**  
(800) 332-9923  
(310) 322-0200  
fax: (310) 322-3242  
**Circle 1039 on Inquiry Card.**

**Intellisoft, Inc.**  
(800) 933-4889  
(817) 467-7243  
fax: (817) 467-7133  
**Circle 1040 on Inquiry Card.**

**Interleaf, Inc.**  
(800) 666-5323  
(617) 290-0710  
fax: (617) 290-4943  
**Circle 1041 on Inquiry Card.**

**Knowledge Garden, Inc.**  
(516) 246-5400  
fax: (516) 246-5452  
**Circle 1042 on Inquiry Card.**

**Micrografx, Inc.**  
(800) 733-3729  
(214) 234-1769  
fax: (214) 234-2410  
**Circle 1043 on Inquiry Card.**

**Microsoft Corp.**

**Netmanage, Inc.**  
(408) 973-7171  
fax: (408) 257-6405  
**Circle 1044 on Inquiry Card.**

**Oracle Corp.**

**The Periscope Co., Inc.**  
(404) 875-8080  
fax: (404) 872-1973  
**Circle 1045 on Inquiry Card.**

**Software Publishing Corp.**  
(408) 986-8000  
fax: (408) 980-0729  
**Circle 1046 on Inquiry Card.**

**Software Ventures Corp.**  
(510) 644-3232  
fax: (510) 848-0885  
**Circle 1047 on Inquiry Card.**

**Symantec Corp.**  
(800) 441-7234  
(408) 253-9600  
fax: (408) 253-4092  
**Circle 1048 on Inquiry Card.**

**Titan Applications**  
(703) 883-9200  
fax: (703) 821-3351  
**Circle 1049 on Inquiry Card.**

**VisiSoft**  
(800) 847-4638  
(404) 874-0428  
fax: (404) 874-6412  
**Circle 1050 on Inquiry Card.**

**Wall Data, Inc.**  
(800) 487-8622  
(206) 883-4777  
fax: (206) 885-9250  
**Circle 1051 on Inquiry Card.**

**Wolfram Research, Inc.**  
(800) 441-6284  
(217) 398-0700  
fax: (217) 398-0747  
**Circle 1052 on Inquiry Card.**

**XBD Systems, Inc.**  
(800) 488-4948  
(301) 317-6800  
fax: (301) 317-7701  
**Circle 1053 on Inquiry Card.**

*Inclusion in the resource guide should not be taken as a BYTE endorsement or recommendation. Likewise, omission from the guide should not be taken negatively. The information here was believed to be accurate at the time of writing, but BYTE cannot be responsible for omissions, errors, or changes that occur after compilation.*



# Performance Plus Protection



Spanned For Performance

Mirrored For Protection



Fast SCSI-2 BusMastering Host Adapters

## Fault-Tolerant File Servers, Fast as 5.5 ms

Today's network managers face more mission-critical data residing on individual servers. MicroNet knows you need cost-effective storage solutions offering the ultimate in performance *plus* protection.

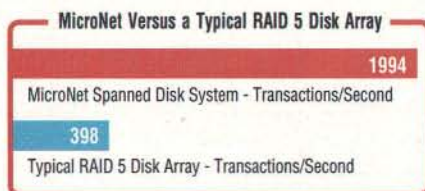
We've engineered our storage systems, featuring Seagate high performance drives, to optimize the built-in features of NetWare. By spanning multiple Elite-2 hard disc drives, and multiple host adapters, access times drop as low as 5.5 ms and sustained data transfers climb to an astonishing 12 MB/sec.

But there is another side to the story. Your data needs protection. If a server goes down, rapid data recovery is essential. Mirroring the hard disc system creates an on-line duplicate of the data, should

anything go wrong with the primary drive. If a fault occurs with the CPU, the complete drive chain can be moved to an ISA, EISA, or MCA workstation using a MicroNet host adapter to create an instant file server!

MicroNet systems offer full protection all the way to the controller card level. Our NetWare device drivers allow a disc drive to be changed on-the-fly. And we offer these features without being locked into a proprietary software or hardware system.

Protection while minimizing down-time is one side of the story. Productivity is the other. By utilizing a MicroNet high performance storage solution, you get performance *plus* protection. Call MicroNet today for more information. 1-714-581-1540.



Performance *Plus* Protection, Without Compromise.

## MicroNet Technology, Inc.

20 MASON • IRVINE, CA 92718 • TEL: (714) 837-6033 • FAX: (714) 837-1164  
AppleLink: MICRONET.SLS • Compuserve: 76004,1611

Seagate and the Seagate logo are registered trademarks, and Elite is a trademark of Seagate Technology, Inc. All other trademarks are property of their respective owners.

Circle 127 on Inquiry Card (RESELLERS: 128).





# THE NEW WAVE OF REMOVABLE STORAGE

**The BYTE Lab helps you  
find the right removable  
data storage system**

**RAYMOND GA CÔTÉ  
AND STANLEY WSZOLA**

**D**o you ever have the feeling that the data gremlins get together at night and make up more data to tuck away on your drives? No matter how large the new drive you've added to your system, it is soon filled.

Applications keep getting fatter, especially with the trend toward graphical interfaces. Operating systems are more stor-

age hungry than ever. And most of you are swimming hard to keep afloat in the daily data streams—intraoffice E-mail, electronic stock reports, spreadsheet reports, and interoffice faxes. Today, more and more information is being transmitted as graphical images: faxes, forms, charts, electronic circuit diagrams, photos of the new corporate headquarters, and on and on. At this rate, in 10 years you'll be adding gigabyte drives to your systems and seeing them fill in a day or two.

Add to the explosion of data the growing importance of security, and you have an obvious need for a removable-storage system. In this month's Solutions Focus, we take a look at some of the options in removable storage and try to sort out the field by analyzing each class of device for performance, cost, reliability, and suitability for primary and secondary storage across all major platforms.

To this end, we have taken a sampling of products from each category: (1) MO (magneto-optical) drives (Epson America's OMD-5010-100, Image Network Technology's Infinita 128, Ocean Microsystems' Vista 128, Panasonic's LF-3000, Pinnacle Micro's PMO-650 and REO-130S, Relax Technology's Rewritable Sierra 128, and Sony's RMO-S350); (2) floptical drives (Procom Technology's Floptika 20); (3) magnetic-cartridge drives (Iomega's Bernoulli Transportable 90 Pro and Bernoulli PC Powered 90 Pro, Microtech International's R50, Peripheral Land's Infinity 88, and SyDOS's 88e); (4) docking drives (Mass Memory Systems' Disk Pack and Quantum's Passport XL); and (5) parallel-port drives (DiscTec's RoadRunner XD-120, Micro-Solutions' Backpack, and Sysgen's Mobile Disk MD120).

In each case, we evaluated the hardware mechanisms so as to differentiate the performance of each class. Based on those evaluations, we're able to make recommendations about which applications are best suited for each type of technology. We







## BYTE ACTION SUMMARY

### ■ WHAT IS REMOVABLE STORAGE?

Alternatives to fixed hard drives designed to help you deal with growing sets of data.

### ■ LIKES

Convenience and expansion capabilities are pluses. With MO (magneto-optical) media, data won't be prey to stray magnetic fields.

### ■ DISLIKES

Removable drives are relatively slow, but they sure beat the wait with tapes. Most of these drives are not the best solution for primary storage.

### ■ RECOMMENDATIONS

Removable hard drives are the answer if security is your primary concern. Parallel-port devices are a good choice if you will be shuffling the drive around from one system to another; they are also a good solution for expanding the drive capacity of notebook computers. But for most removable-storage applications, the future belongs to MO. If you can, wait for the market to develop, speeds to increase, and prices to drop. Among the MOs tested in this review, we pick the Rewritable Sierra 128 from Relax Technology.

also selected a price/performance stand-out in the MO category.

In our performance evaluations, we did not use the special drivers, adapters, or software that you can usually buy from authorized dealers. Our intent is to help you choose the type of removable storage that is right for your needs. You should then seek out the dealer with the best overall package. (For an overview of the basic specifications for each device, check out the table on page 200.)

Another important consideration is the cost of the media used in the drives. For a comparison of the costs of the various removable-storage technologies, refer to the table and to figure 2. The MO drives offer a clear advantage.

### Catching the Wave

The classic solution to "putting data on the shelf" has been tape of one form or another. Solutions ranging from traditional, and still acceptable, nine-track tape to sophisticated DAT (digital audiotape) let



## REMOVABLE-STORAGE DRIVES

When evaluating the features of removable-storage drives, you should consider the cost of the unit as well as the adapter card. Average seek time provides a good starting point for determining suitability for primary storage. Fixed hard drives usually have seek times ranging from 19 to 28 ms. (● = yes; ○ = no; N/A = not applicable; MC = Micro Channel.)

## MAGNETO-OPTICAL DRIVES

Vendor	Epson America	Image Network Technology	Ocean Microsystems	Panasonic	Pinnacle Micro	Pinnacle Micro	Relax Technology	Sony Corp. of America
Model name or number	OMD-5010-100	Infinita 128	Vista 128	LF-3000	PMO-650	REO-130S	Rewritable Sierra 128	RMO-S350
Internal or external	Int.	Int.	Ext./Int.	Ext./Int.	Ext.	Ext.	Ext.	Ext.
External unit size (in.)	N/A	N/A	2.1 × 9.7 × 10.4	3.8 × 6.2 × 10	7.4 × 10.1 × 3.7	2.2 × 6.8 × 8.8	4 × 1.6 × 5.8	9.7 × 11.2 × 2.9
Weight (lbs.)	1.53	1.76	8	7.7	7.4	4.8	1.76	9.9
Platforms supported	Mac, PC, Next, Sun	Mac, PC	PC	Mac, PC	Mac, PC, PS/2, Sun	Mac, PC, PS/2, DEC, Sun	Mac, PC, PS/2, Sun	Mac, PC, PS/2
Internal or external power supply	N/A	N/A	Int.	Int.	Int.	Int.	Int.	Int.
Transfer speed in MBps	0.768	4	0.5	4	4.2	0.625	4	7.25
Average seek time (ms)	38	45	35	40	19	38	39	40
Interface (SCSI, parallel port)	SCSI	SCSI-2	SCSI	SCSI	SCSI	SCSI	SCSI-2	SCSI-2
Interface adapter available	○	●	●	●	●	●	●	●
Brand of interface adapter	N/A	Adaptec	Adaptec, Future Domain	Panasonic	Adaptec, Future Domain	Adaptec, Future Domain	Trantor, Future Domain	Adaptec
Cost of adapter	N/A	\$265	Varies	\$175	Included	Included	Included	\$350 to \$450
Warranty	1 year	1 year	1 year	1 year	1 year	1 year	1 year	1 year
<b>List Price:</b>								
Standard configuration	\$1000 OEM quantities	\$1699 w/ interface adapter	\$1999	\$2195; Int. version, \$1795	\$3995 to \$4195	\$1995 to \$2395	\$1299 to \$1749	\$2295
Options			256-MB drives	Interface adapter and software				SCSI adapter
<b>Media:</b>								
Size in MB	128	128	128	128	650	128	128	128
Manufacturer	Epson, Sony	Ricoh	Several sources	Panasonic	Digital Optical Tech.	Epson, Sony	Ricoh	Epson, Sony
Cost per disk or cartridge	\$64	\$70	\$67	\$89	\$199	\$79	\$49	\$64
Cost per MB	\$0.50	\$0.55	\$1.91	\$0.70	\$0.30	\$0.61	\$0.38	\$0.50

you back up, archive, and safely remove files from your primary system. Tape storage has one overriding problem: accessibility. Retrieving files from tape can be a long and tedious process. Magnetic tape is a sequential, not random, access device and is unsuitable for use as a primary-storage medium. Long-term storage is its best use.

Between the high-speed, high-accessibility features of your primary hard drive and the low-speed, low-accessibility characteristics of a magnetic tape system lies the fuzzy realm of secondary storage. The secondary-storage devices we discuss have several common traits: They all provide a removable medium, they are slower than standard fixed hard drives, and the cost

per megabyte is less than that of a standard hard drive. Except for the Bernoulli PC Powered 90 Pro, all the products reviewed connect through either a SCSI peripheral interface or a system's parallel port.

## Lights and Flux

**M**agneto-optical drives (see photo 1) represent some of the newest technology available in the marketplace. Combining lasers with relatively conventional magnetic write heads, MO drives and disks represent a high-density, reliable storage option.

Figure 1 shows how an MO drive works.

A fixed semiconductor laser bounces light off a mirror mounted on the end of a movable arm located directly under the rapidly spinning disk. A magnetic write head is positioned on the opposite side of the disk (this head is large enough to cover the radius of the disk).

Writing data to the disk is a two-step process. First, the magnetic write head is turned on so as to write 0 bits to the disk. The laser is used in high-power mode to heat the disk surface to the Curie point (i.e., about 180°C). Once the surface is heated, the magnetic field exerted by the write head produces a change in magnetic polarity on the disk. As the disk quickly cools, it retains this new magnetic polarity. On the second pass, the polarity of the



## REMOVABLE-STORAGE DRIVES

MAGNETIC-CARTRIDGE DRIVES					DOCKING DRIVES		PARALLEL-PORT DRIVES			FLOPTICAL DRIVE
lomega	lomega	Microtech International	Peripheral Land, Inc.	SyDOS	Mass Memory Systems	Quantum	Disctec	Micro-Solutions	Sysgen	Procom Technology
Bernoulli Transportable 90 Pro	Bernoulli PC Powered 90 Pro	Microtech R50	Infinity 88	SyDOS 88e	Disk Pack	Passport XL	Road-Runner XD-120	Backpack	Mobile Disk MD120	Floptika 20
Ext.	Ext.	Ext./int.	Ext./int.	Ext./int.	Ext.	Ext./int.	Ext.	Ext.	Ext.	Ext.
2.7 x 9.8 x 11.8	2.7 x 6.7 x 10.7	2.5 x 9.7 x 10.7	2.4 x 9.8 x 9.8	2.6 x 9.7 x 9.7	5.7 x 4.5 x 9.8	9.4 x 9.4 x 2.3	3.2 x 6.1 x 2.3	4.2 x 7.9 x 1.7	7.8 x 4.7 x 2	2.4 x 9.6 x 10.5
8.1	6.1	7.2	4.5	7.5	5.2	8.5	1.5	2.5	2.3	6
Mac, PC, PS/2	PC, PS/2	Mac, PC, PS/2	Mac, PC, Next, Atari	PC	Mac, PC, PS/2, DEC, Sun, TI	Mac, PC, PS/2	PC	PC	PC	Mac, PC
Int.	N/A	Int.	Int.	Int.	Int.	Int.	Ext. or battery	Ext.	Ext.	Int.
20	20	2	1.25	4	5	1.4	0.2	0.33	0.25	0.2
30	30	25	20	20	17	18	19	19	19	80
SCSI	SCSI	SCSI	SCSI	SCSI, parallel	SCSI-2	SCSI-2	Parallel	Parallel	Parallel	SCSI
•	•	•	•	•	•	•	N/A	N/A	N/A	○
lomega	lomega	Microtech	PLI	SyDOS	Bustek	Future Domain	N/A	N/A	N/A	N/A
Included	Included	PC, \$229 MC, \$499	\$100	\$499	\$589	PC, \$194 MC, \$214	N/A	N/A	N/A	N/A
1 year	1 year	2 years	2 years	2 years	1 year	2 years	1 year	1 year	1 year	1 year
\$949 \$713 (Mac) \$949 (PC)	\$855	\$1299	\$1099	\$1299 w/ interface adapter	\$1158	\$1201	\$1450	\$795	\$895	\$585
Interface adapter, \$265	Interface adapter, \$265		Carrying bag		Double docking bay; 52-MB to 1.05-GB drives	50- to 240-MB drives				
90	90	50	88	88	105	105	120	100	120	20.8
lomega	lomega	Ricoh	SyQuest	SyQuest	Mass Memory	Quantum	Disctec	Teac	Sysgen	Insite, 3M, Maxell
\$229	\$229	\$129	\$199	\$278	\$1099	\$629	\$1450	\$795	\$895	\$45
\$12.04	\$12.04	\$2.58	\$2.26	\$3.15	\$10.40	\$5.99	\$12.08	\$7.95	\$7.45	\$2.15

magnetic field is reversed. This time, only the portions of the disk that represent 1 bit are written.

The laser reads the MO disk in low-power mode. Due to a process known as the Kerr effect, the plane of polarized light is rotated when it reflects from a magnetized surface. In MO drives, the polarization plane rotates clockwise when reflected from a 1 bit, and counterclockwise when reflected from a 0 bit. This polarization shift is easily detected and translated into a stream of electrical 0s and 1s.

### The Perfect Answer?

Unlike conventional hard and floppy drive technology, which requires a read/write head to come very close to, or to actually

touch, the rapidly spinning magnetic disk, MO components can maintain a safe distance. Thus, head crashes are not a problem, nor is there the wear problem associated with floppy disks, which require physical contact.

Because MO disks must be heated before their stored magnetic fields can be changed, they are impervious to the magnetic fields normally encountered in the office or travel environment. Gone are the concerns about placing a telephone on your disks, storing them too close to a fluorescent lamp, or passing them through an airport x-ray machine. (Note: it's not the x-rays that cause problems, it's the magnetic field emanating from the motors in the conveyor system that erases the disks.)

MO cartridges are fairly robust. They can be dropped without much concern. If the case breaks, you can simply transfer the disk to a new case as long as the disk surface has not been scratched. Epson goes so far as to recommend that if you spill coffee on a disk, simply wipe it off. Disk-cleaning kits are available for removing spills of sugary beverages that may leave a film that will prevent the laser from reading the data.

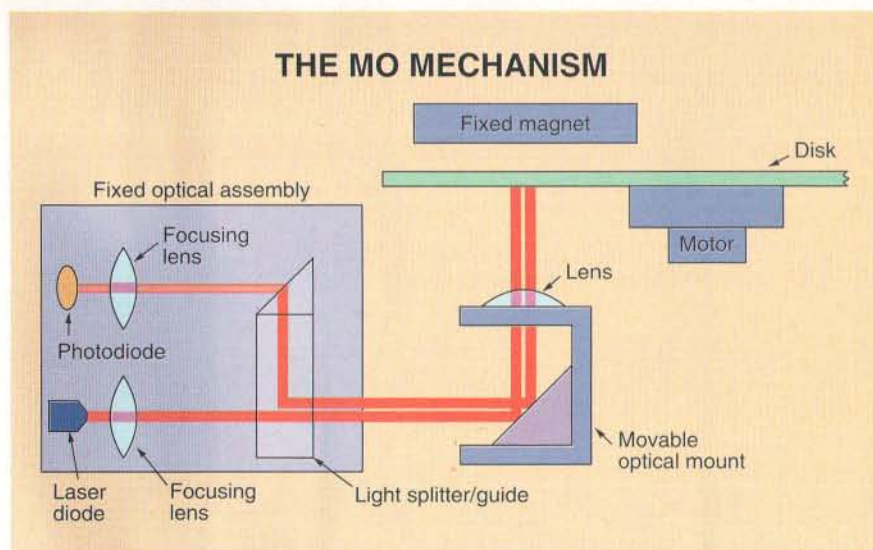
MO drives are also fairly inexpensive. Right now, the drives are more expensive than the cartridge-based units such as those made by SyQuest, but the media costs are less, especially when you look at the cost-per-megabyte ratio.

MO is starting to sound like the ultimate





**Photo 1:** A collection of internally and externally mounted MO drives.



**Figure 1:** MO drives use a combination of lasers and magnetics to write data. As the laser heats the disk, the magnet writes the data onto the surface. A low-power laser beam is used to read the data back. One sizable advantage is the ability to read and write information without getting close to the spinning magnetic medium. Wear and tear on the MO disk is slight.



**Photo 2:** MO drives generate large amounts of heat. Ricoh mounts a small fan on the back of its drive to blow air through the mechanism and out the front of the drive.

nally mounted MO drives can come with their own ventilation systems, designers of internally mounted MO drives are not able to take into consideration the heat and airflow characteristics of every computer system.

Ricoh has addressed this problem by mounting a small squirrel-cage fan (see photo 2) at the back of its MO drive that blows air through the drive and out the front. Although the fan doesn't get in the way if you are installing the system in an externally mounted box, you must consider the added protuberance if you want to mount this drive inside your PC case. Due to the increased heat generated by these drives, you really should avoid mounting them internally. Many of the smaller PC cases are already pushing the heat constraints to the limit. Replacing older 386SX and 386DX chips with the accelerated clock-doubler chips only adds to the heat burden. For now, MO drives appear relegated to external boxes.

## MO Performance

As the benchmark results in figure 2 show, MO drives are slower than standard SCSI hard drives, but not so much slower as to make it impractical to use them for primary as well as secondary storage. The judicious arrangement of Windows swap files on your primary hard drive and the addition of an efficient disk cache will produce acceptable, but not stunning, performance.

One aspect of the MO disk that is not yet being exploited is its ability to store read-only data as well as read/write data on a disk. During manufacturing, small physical data pits can be stamped onto the disk to represent a stream of data. These pits alter the laser beam in much the same manner as magnetic polarity, producing a stream of 0 and 1 bits. This is the technique now used to stamp manufacturing and positioning information onto MO disks. Possible uses of this technology include reference works that allow customization and reusable workbooks that students can write in during a course and then are erased at the end of the term.

The one unknown about MO disks is storage life. Although laboratory tests indicate a 10-year period, the disks have simply not been around long enough, nor been made in sufficiently large quantities, to indicate how long you can leave them on the shelf and still expect to find your data. The fact that the disk must be physically heated to change the magnetic contents is a definite plus, but only extended use will provide the final answers.

MO drives are a reasonable solution to the expanding primary-storage problem.

*continued*

storage technology, but it has some disadvantages. The primary drawback is speed. Since writing is a two-step process, the disk must complete two revolutions before data is completely transferred. Although some laboratory systems can write in a single pass, these are not yet commercially practical.

Another problem is heat. Unlike other parts of your computer, where much engineering effort has been spent to reduce heat, MO drives contain a laser designed to heat up small portions of the disk surface to nearly 200°C. When you eject an MO cartridge, it's warm. Dissipating heat is always a problem, particularly in the 3½-inch MO drive format. Although exter-



# Who's Really The Fastest?

DRIVES COMPARED FOR 50Mb TRANSFER\* (in seconds)

Alphatronix INSPIRE® II	77.83
Quantum® 105s hard drive	91.95
Pinnacle PMO-650™ "optical hard drive"	102.82
Sony® SMO-E501 optical drive	155.50

## You Make The Call: 1-800-849-5807.

As you can see, the INSPIRE II optical drive is far faster than the much-ballyhooed "optical hard drive," is comparable to your typical hard drive and is many times faster than previous optical drives. And the INSPIRE II is made with the superior quality and reliability that has made Alphatronix the acknowledged leader in high-end optical systems.

### Call The Source Of Optical.

Our reputation for quality and innovation goes back to 1988, when we shipped the world's first rewritable optical system. In 1989 we were presented the national Distinguished Inventors award. In the years since, we've received even more national awards for quality and excellence. Alphatronix has become the hands-down choice of some of the world's toughest customers, including NASA and the Lawrence Livermore National Laboratories.



### Gain Significant Advantages.

Now that same level of quality, performance and support is available for your PC, PC-compatible, Mac, DEC or UNIX workstation at a lower cost per megabyte. You can have the speed of a hard drive with the added advantages of optical: greater reliability and more megabytes on a removable, portable media. Aside from having vastly more storage, your system will never know the difference. INSPIRE II lets you simply "plug and play".



The world's first  
optical drive is now  
the world's fastest.

### Why Waste Time?

So what are you waiting for? You know who's got the fastest optical drive, and you know who's got the best. Stop waiting and call us today at 1-800-849-5807. We'll send you free comparative test results, specs and everything you need to order the INSPIRE II. Only you can make the call.

SEEK TIME  
(in milliseconds)

INSPIRE II 23

Pinnacle PMO-650 39

Actual times recorded in identical tests for average time to seek to any random sector on disk.



ALPHATRONIX® *The Source Of An Industry.*

P.O. Box 13687, Research Triangle Park, NC 27709-3687 Phone (919) 544-0001; Fax (919) 544-4079

\*Read 50 Mb data stored in sequential sectors at 32 Kb/read request. Complete details of benchmark environment and procedures available upon request. Alphatronix, the Alphatronix logo, and Inspire are U.S. registered trademarks of Alphatronix, Inc. Other trademarks and product names are the property of their respective owners.

For Macintosh information circle 64; for IBM/Compatible information circle 65; for UNIX information circle 66 on inquiry card.



They provide reasonable performance at a reasonable price, with the added benefit of using a disk that is basically immune to extraneous magnetic interference.

### The Optical of Our Eye

When it came to selecting the best MO drive, we were hard-pressed to find clear differences among the drives. Our benchmark testing returned very similar performance results across the different mechanisms. Specialized drivers can improve a drive's performance, but we see a clear trend away from proprietary configurations. In most business settings, you will be better served by a standardized adapter and driver solution that accommodates the addition of other SCSI devices.

Given this philosophy and our benchmark findings, we suggest that you should not be unduly concerned about a drive's performance. Developments in MO tech-

nology will produce drives with faster access times, but for now MO performance is too close to call.

Performance being equal, we examined price and software bundles. Keep in mind that there are many other MO resellers in the market, including Liberty Systems (Santa Clara, CA), Rodime Systems (Boca Raton, FL), and GCC Technologies (Waltham, MA). Shop around before making your final decision.

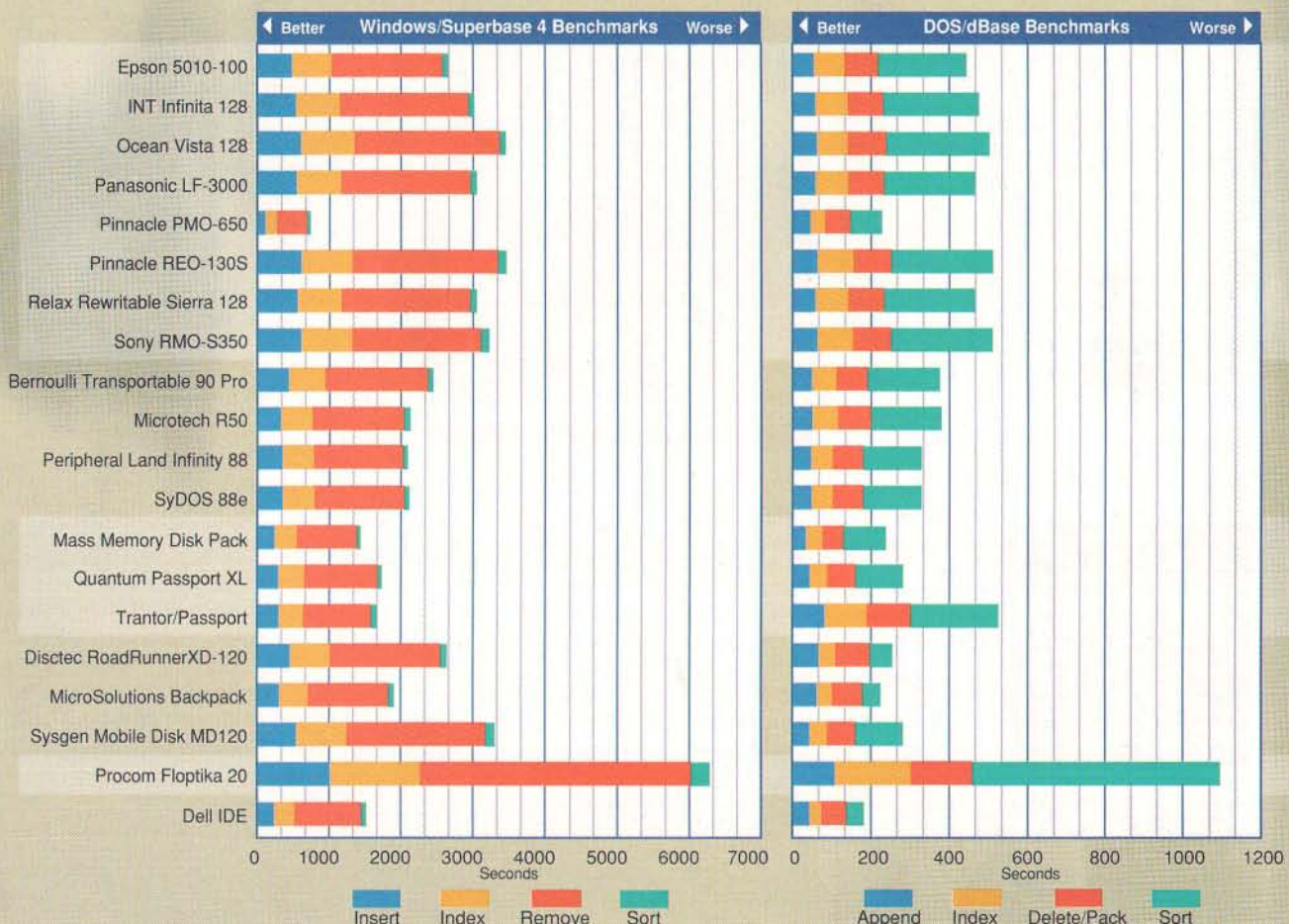
Among the MO drives evaluated here, we liked the Rewritable Sierra 128 from Relax Technology best. The Ricoh mechanism has been on the market for some time and seems reliable, and the fan helps allay any concerns about the drive overheating. The MO cartridges are reasonably priced. The Relax catalog lists a 128-MB cartridge for \$49 and a set of five cartridges for \$225. Five cartridges would give you 640 MB of storage capacity for

less than 35 cents per megabyte. The drive itself costs \$1299 for the Mac kit and \$1399 for the PC kit (with an interface card). Relax also offers a package for the Sun platform for \$1749. If you already have a SCSI adapter card, you'll pay even less. That all adds up to the best pricing among the group of MO drives reviewed here. We think Relax Technology offers the best total package.

### The Floptical Future

There is something very comforting about 3½-inch floppy disks. They are familiar, rugged, and highly portable. Several of them fit comfortably in a pocket; they don't bend; and we don't go into shock when they are dropped on the floor. The primary limiting factor is their relatively small capacity: 720 KB to 1.44 MB

## REMOVABLE-STORAGE DRIVE PERFORMANCE

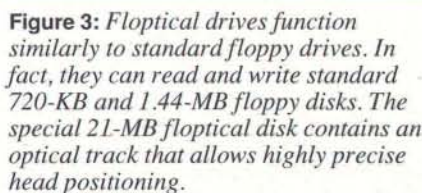


**Figure 2:** Our benchmark suite includes file I/O-intensive applications under Windows and DOS. In some cases, you can expect better performance using vendor-supplied drivers. Products are grouped by technology.



Floptical disks take this comfortable size and pack the equivalent of an early 1980s hard drive (i.e., 21 MB) inside. The key is optical servo positioning. Floptical drives are closely related to standard 3 1/2-inch floppy drives.

Figure 3 shows how the floptical technology works. Magnetic read/write heads are positioned on both sides of the disk and touch it as it spins. What differentiates this setup from standard floppy drive technology is the addition of an optical sensor that sits beside the bottom head. This sensor detects an optical positioning pattern that has been laid down on the floptical disk. The increased positioning accuracy acquired by using this pattern, in addition to the use of a very thin magnetic head, allows data tracks to be positioned an order of magnitude closer together than on standard floppy disks.



**Figure 3:** Floptical drives function similarly to standard floppy drives. In fact, they can read and write standard 720-KB and 1.44-MB floppy disks. The special 21-MB floptical disk contains an optical track that allows highly precise head positioning.

A primary selling point of the floptical drive is its ability to read and write normal 720-KB and 1.44-MB floppy disks in the same drive used for the 21-MB floptical disks. This added functionality requires a magnetic write head with the dual capability of writing both extremely thin and normal magnetic patterns.

Along with all the benefits of floppy drive-style technology come some of the disadvantages. Floptical drives are not fast. Since the drives spin at normal floppy drive speeds, performance is equivalent to that of floppy drives. You probably won't be doing a lot of database work or program development on these drives. Also, the floptical disks are as sensitive to stray magnetic fields as normal floppy disks. Thus, you have to keep them away from telephones, monitors, and other sources of magnetic interference.

The cost per megabyte of floptical disks, coupled with the benefit of random access, makes them ideal candidates for keeping spare copies of frequently accessed files.

Currently, all floptical drives are licensed from Insight Peripherals, so they will not vary much from vendor to vendor. The performance and features offered by Procom's Floptika 20 are generally what you can expect from other floptical drives. With that in mind, you can focus on finding a floptical drive with the best price and software bundle, without worrying much about hardware differences.

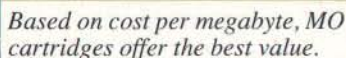
**I**f you want your data to fly—really fly—then Iomega's Bernoulli drives are the answer. A continuing problem with many drive technologies is the need to get

the disk very close to, but not touching, the magnetic read/write heads. Bernoulli drives solve the problem of positioning by forcing the disk to approach the heads, rather than have the heads approach the disk. The rapidly rotating disk is flexible, like a normal floppy disk, and drags along the surrounding air as it moves. When the air mass encounters the restricted airflow between the disk and the read/write heads, it accelerates. The air on top of the disk moves faster than the air on the bottom of the disk. According to an effect first documented by Daniel Bernoulli, an eighteenth-century Swiss mathematician, the pressure exerted by the airstream increases as the speed of the airstream decreases. Thus, the slower-moving air under the disk presses it toward the upper read/write head. The newer Bernoulli 90-MB cartridges stand this effect on its head by using a second disk, which is pulled down by the Bernoulli effect to approach the lower read/write head. (See figure 4.)

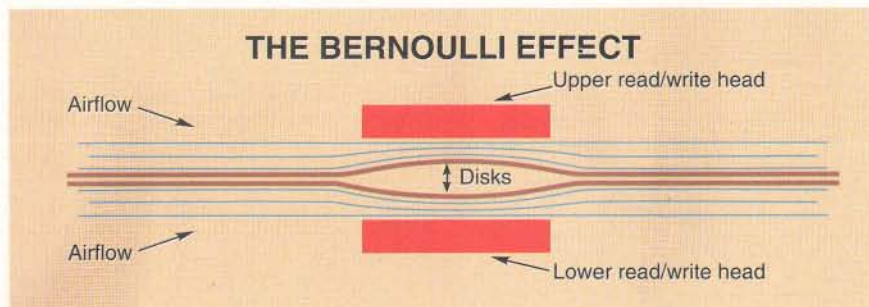
Due to the Bernoulli effect, the read/write head never actually touches the magnetic disk. In traditional hard drives, the read/write head "flies" over the spinning disk. However, when the power is suddenly removed, the disk spins down and the head can touch the disk surface, causing a crash. More important, physical jolts and shocks can bounce the head, causing it to crash into the disk surface. Since the Bernoulli drive pushes the disk toward the head, rather than having the head fly over it, it becomes much more difficult for the head to contact the surface. This results in a highly reliable device, particularly in an environment where you may move an external hard drive, either intentionally or accidentally. The Bernoulli is a very good choice if you need to send your cartridge through the mail. The trade-off is a high cost-per-megabyte ratio.

Aside from the flying disks, the Bernoulli drive uses fairly conventional floppy drive-style technology. The performance of the Bernoulli is a bit better than that of the MO drives, but the same caveats apply when using the Bernoulli drive for primary storage. It works extremely well as expandable secondary storage. We have had an earlier version of the Bernoulli drive in the BYTE Lab for over five years, and it is still chugging away with the original cartridges.

The newest Bernoulli device, Iomega's PC Powered 90 Pro, draws power directly from your computer, adding some convenience but requiring a proprietary adapter card. The power connector hangs off the interface card and plugs into your PC's







**Figure 4:** In the new Bernoulli Transportable Pro, each disk approaches a read/write head. This technology reduces the threat of head crashes to near zero.



**Photo 3:** Removable drives come in many shapes and sizes besides MO drives. The SyDOS and Microtech drives provide removable hard disk platters. The Procom floptical drive, in addition to supporting 21-MB floptical disks, can also read and write standard 720-KB and 1.44-MB floppy disks. The Bernoulli drive provides high-speed access using sturdy 90-MB cartridges.

power supply. The interface card also includes a double-headed connector, so if other peripherals require all the plugs available to your power supply, you can connect the Bernoulli drive and a second peripheral through the same plug. If you're simply looking for an additional drive to supplement the disk capacity on your desktop computer and you want an option that is expandable, the PC Powered 90 Pro is a good choice.

## Magnetic-Cartridge Drives

Products such as the Microtech R50, the PLI Infinity 88, and the SyDOS 88e (see photo 3) consist of a standard hard drive platter mounted in a removable cartridge. When the cartridge is inserted

in the drive, the platter spins up to speed, at which point the drive heads move out over the platter and fly along it, exactly like standard hard drive heads. The primary difference between removable-cartridge drives and standard hard drives is capacity. The ability to cram more information into smaller spaces is directly related to the ability to move the read/write heads close to the spinning platter. In a standard hard drive, the heads and platter are isolated from outside dirt particles by a sealed case containing high-quality air filters. This is not the case with removable-cartridge drives.

### More Dust, Lower Density

Peek inside the front of a removable-cartridge drive, and you will see the read/write heads hanging out at the back of the mechanism. As these heads move over the rapidly spinning disk, they are not in a sealed environment, nor has the surrounding air been passed through an ultra-pure filter. Because of this, the drive environment contains more and larger dust particles than are present in standard hard drives. Since they operate in a dustier environment, these drives must keep the heads farther from the platter. Being farther from the platter means lower densities. Thus, a 5¼-inch platter holds a maximum of 88 MB of usable data.

Although not providing top densities, removable-cartridge drives do deliver high speeds. However, these manufacturers should be looking over their shoulders at the increasing speeds of MO drives. If you are working with service bureaus or other professional services, a SyQuest drive, such as the SyDOS 88e or the Infinity 88, is your best bet. In these environments, the 44-MB SyQuest cartridge has become a standard transport medium. Other vendors in this category include Identity Systems Technology (Richardson, TX), MicroNet Technology (Irvine, CA), and Dynatek Automation Systems (Toronto, Ontario).

## The Real Thing

If security is your primary concern, docking drives (i.e., removable SCSI hard drives) may be your best bet (see photo 4). Systems such as the Quantum Passport XL and the Mass Memory Systems Disk Pack are true primary-storage devices. Their performance is identical to that of internally mounted SCSI hard drives. The difference is that you can remove these drives at the end of the day and tuck them away in the office vault.

Although our test environment used them as secondary-storage devices, it would be quite simple to configure a system where your removable SCSI hard drive was the only primary-storage device. In that case, you would use the SCSI adapter's on-board ROM BIOS to boot from the removable hard drive.

Removable SCSI hard drives have all the advantages and disadvantages of normal SCSI drives. Although they are the fastest removable-storage device you can hook up to your system, they are also the most delicate. You probably won't want to be shipping drives of this kind around the countryside on a regular basis. Neither would you want to consider them for long-term archival storage. They are simply too expensive. This technology is best suited for use where security is vital.

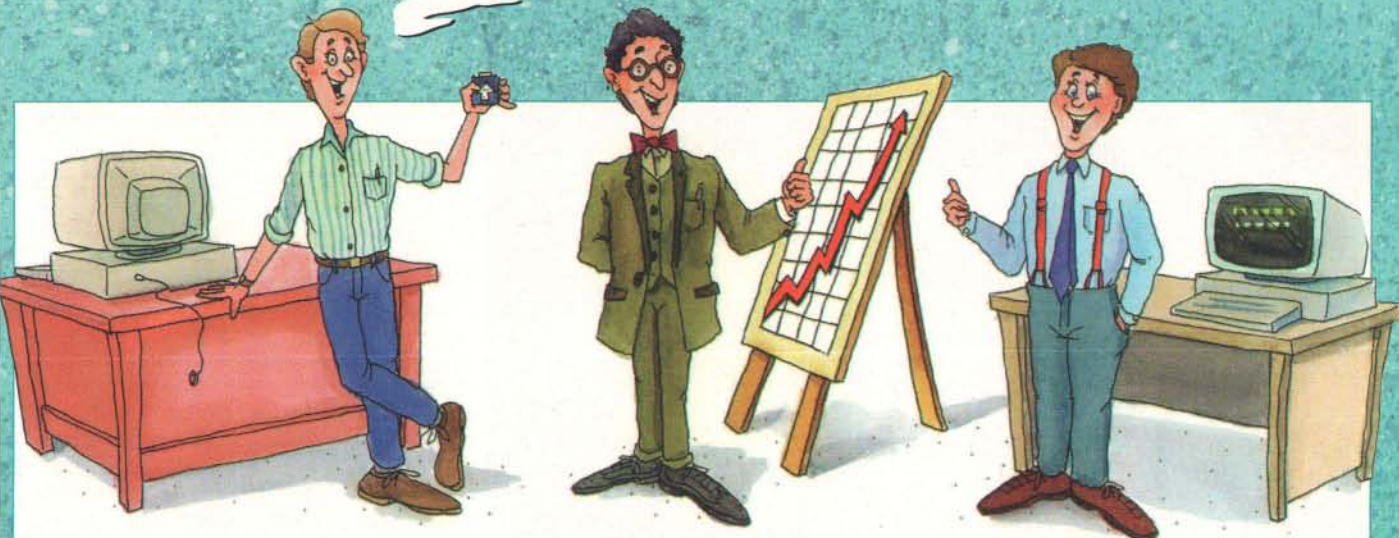
The two systems we evaluated, the Passport XL and the Disk Pack, take slightly different approaches to removability. The Disk Pack seems to be designed for once-a-day installation and removal. In the morning, you would power up your Mass Memory Systems' interface box, push the Disk Pack into the box, and boot your system. Once you place the drive inside the box, a mechanical interlock grabs the drive and prevents you from removing it until the box is powered off at the end of the day.

Quantum's drive holder, on the other hand, is designed for swapping drives during the course of normal daily activity. The Quantum box contains a motor that pulls the drive in for proper seating. Then, at any safe time, the drive can be ejected under software control or by using a small button at the front of the box. This method, while more expensive than the Disk Pack approach, is safer, since the Passport XL will not eject the drive unless there is no disk activity. In addition, it waits for the disk to start spinning down before ejecting the drive, thus reducing the chance of a head crash due to rough handling.

The need to power down the Disk Pack interface before you remove the drive is simply an invitation to disaster, because reaching for the power button is such an



# WHY HARDLOCK IS THE PREFERRED *network* PROTECTION SYSTEM



## Developers Say...

"Hardlock is Networking! Now everyone on the Network can access my application without having the Hardlock on their PC. NET Hardlock's interface allows me to easily limit the number of simultaneous users without having to build this up myself. Since NET Hardlock contains an algorithmic response ASIC, I'm assured of the highest level of protection. And Glenco's software interface choices couldn't have been easier to use!"

## Accountants Say...

"NET Hardlock is a welcome addition to the Hardlock family of revenue protection products. Now limiting and expanding the simultaneous user portion of the license agreement is the easy part! Our costs are lowered and the end user benefits - it's a perfect solution!"

## End Users Say...

"NET Hardlock is the easiest protection system I've ever used! Once the NET Hardlock is plugged in, I don't even know it's there. Now the application can find the NET Hardlock regardless of which PC I'm using. We can easily add more users to the license without shipping Hardlocks back and forth. Just knowing the software developer is paid for their efforts makes me feel confident that the next upgrade is coming and my investment is secure!"

### Other products in the Hardlock Family:

Hardlock & Hardlock with Memory (Single User)  
Hardlock DES (Data Security)  
Hardlock SE (Workstations)

Call for your 30-Day No Risk Evaluation Kit!

**Supporting Windows, DOS, OS/2, Unix**



Shown actual size.

*The only product that combines a memory option with programmable, algorithmic response — all in one compact unit.*

Made in the USA

**GLENCO**   
ENGINEERING INC.  
SERVING THE SOFTWARE INDUSTRY SINCE 1979

**1-800-562-2543**

270 Lexington Drive Buffalo Grove, Illinois 60089-6930  
708/808-0300 Fax: 708/808-0313

For a distributor in Europe contact Fast Electronic GmbH, Tel: 49-89-538-800-0 Fax: 49-89-539-800-40  
In Korea contact Finecom, Tel: 82-2-690-5811 Fax: 82-2-605-5729 In Brazil contact HT-MACH, Tel: 21-257-0314 Fax: 21-235-6808  
In Chile contact Datasoft S.A., Tel: 562-246-7443 Fax: 562-208-0591 In Peru contact V.C.H.I., Tel: 51-14-440537 Fax: 51-14-475984  
For International information circle 108, For End-User information circle 109 on Inquiry Card.





**Photo 4:** A collection of alternative drives. Removable hard drives best answer security requirements, but you won't want to ship them from place to place. Parallel-port-based drives are suitable for moving large files among machines or increasing the storage capacity of portable computers.

unconscious move that you don't necessarily notice that the computer is still writing to the drive.

We have taken a very small sampling of removable SCSI hard drives to represent the category. There are many drives of this kind on the market. Many hard drive vendors also sell removable versions of their products. You should evaluate them much as you would a fixed hard drive, while taking into account the mechanism used for removability.

## Through the Interface

Although they are only peripherally related to the problem of expandable storage, interfaces that connect hard drives and other SCSI devices to a system's parallel port are becoming more and more popular. These parallel-port connections are either hard-wired to a hard drive, as the MicroSolutions Backpack is, or, as with the Trantor T338 MiniSCSI (a \$159 parallel-to-SCSI host adapter), translate the signals from the parallel port into a SCSI port.

As the benchmark figures show, these systems are much faster than you would first expect. Their primary benefits are portability and the ability to connect to just about any computer with a parallel port without having to install internal hardware.

Parallel-port drives are a boon to our BYTE Lab testing. They allow us to con-

figure a single drive with our test requirements and then quickly copy the information over to any test system—no interface cards, no network setup, no need even to open the system's case.

We have been using the Backpack for some time and can recommend it as a portable storage tool. In fact, the parallel port is becoming a popular way to connect to a number of storage devices: floppy drives, tape backup systems, and even CD-ROM drives. Like MicroSolutions, Liberty Systems (Santa Clara, CA) has a full line of parallel-port devices. Other vendors include Vision Logic (San Jose, CA) and Tidal Technology (Alameda, CA). Always Technology (Westlake Village, CA) sells a parallel-to-SCSI device not unlike Trantor's adapter.

## To the Test

We tested all the removable storage devices on a pair of identical Dell 325P (25-MHz 386DX) desktop computers. On both machines we used the bidirectional parallel ports and installed Adaptec 1542B SCSI adapter cards. We also used the Trantor T338 MiniSCSI host adapter on some of the devices to test for compatibility.

All the SCSI-based devices were tested using CorelSCSI device drivers (see the Reviewer's Notebook on page 254 for more discussion of our testing scenario). This was done to ensure that all the devices could work as part of a daisy chain rather than having to depend on any one manufacturer's device driver. We were

also seeking a level playing field for testing the hardware mechanisms. Each drive mechanism is sold by a number of different resellers, each offering its own drivers and added value in the form of software and support.

All the devices were tested with a subset of the standard BYTE application benchmark suite of programs. Under DOS 5.0 we used dBase IV, and under Windows 3.0 we used Superbase 4.0. The database programs provided an I/O-intensive test of each device that corresponded to the way it would be used in the real world.

We did not run into a lot of surprises. The floptical drive was slowest, running at standard floppy drive speeds. The MO drives were next in line, a bit slower than the Bernoulli and SyQuest-based drives. The removable hard drives ran at normal hard drive speeds. The biggest surprise was the performance of the parallel-port drives, the Backpack in particular. Our first thought was that they couldn't be that fast, but in reality they run fast enough for normal, but not intense, usage.

## Know Your Needs

In the final analysis, you must weigh your particular need for expandable mass storage against your requirements for speed and immediate access. If you typically need to ship multimegabyte databases between offices, then floptical drives may be your best choice. The additional speed provided by MO drives and their resistance to random magnetic effects add up to a safe and secure option.

The cartridge drives enjoy the advantage of having been around for a while. The 44-MB SyQuest cartridge, in particular, has become a standard transfer medium on the Mac; whether the 88-MB drive will inherit that audience remains to be seen. You should consider the removable hard drives if security is your main concern.

Parallel-port devices do not require internal cards, so they're a good choice if you routinely need to move a drive around from one system to another. They are also good for expanding the drive capacities of notebook computers.

## The Best Deal

MO looks to us like the wave of the future. The Pinnacle Micro PMO-650, a new 5 $\frac{1}{4}$ -inch 650-MB MO drive, gave us a glimpse of the possibilities. It is expensive—too expensive to recommend now—but that should change as the market develops. The important point about the PMO-650 is its speed. It has a 19-millisecond access time and outperformed



# TAKE A COUPLE OF GIGABYTES OUT OF YOUR DATA STORAGE PROBLEM



If you're like most PC users, the way your computer devours available storage space resembles... well... a feeding frenzy. You never seem to have enough storage capacity, and when you're mobile, it seems impossible to back up your critical data on the road.

Fortunately, paddling to calmer waters and fail-safe data storage is easy with Parallel Peripherals. All you need is one of our sub-systems and a parallel port (no interface card required). You already have the parallel port, and we have the peripherals—in a format and capacity to satisfy the biggest storage appetite.

Ultra-portable, they simply plug-in to the

parallel port on your portable or desktop computer. And each is equipped with an additional printer port pass-through which maintains full printer capability.

Our portable and lightweight drives are true workhorses, providing the most reliable data storage and the most advanced drive features. And with a one-year factory warranty, you can take a bite out of your storage problem without getting bit.

So if your data storage is going down for the third time, let Parallel Peripherals throw you a line. Portable or desktop, we have the right drive in the right capacity. Call (800)222-7240 for more information.



CD-ROM Drive • Dual Floppy Drive • Battery-Powered Hard Drive • Tape Backup • Removable Hard Drive



**MICRO UNITED**





every other device we tested here, most notably on the Windows benchmark suite. The cartridges cost \$199, which works out to a mere 30 cents per megabyte.

For now, you'll have to accept an access time of about 40 ms if you buy any of the 128-MB MO drives currently available. But in such a hot market, you can expect developments to occur quickly. The drives will get faster, and further competition should drive prices down. Keep an eye on the MO vendors for special pricing and software bundles. You should be able to find some good buys. The MO car-

tridge's cost per megabyte is already quite reasonable.

Out of the sampling of MO drives we covered for this Solutions Focus, the Relax Technology Rewritable Sierra 128 is the best deal. The prices for both the drive and the cartridges are the lowest of the group, and the Ricoh mechanism is a proven performer. If you're thinking of buying today, it's a great choice.

On the other hand, you may decide to sit back and wait for the market to develop further and for speeds to increase. But you probably shouldn't wait for too long. For

many applications, MO is now the way to go. ■

*Raymond GA Côté is a BYTE Lab editor continuing his 15-year love affair with computers as tools and toys. Ray has worked in industry designing interpretive languages and user interfaces. His main interest is the creation and maintenance of reliable software. Stanley Wszola is a BYTE Lab testing editor. You can reach them on BIX as "rgacote" and "stan," respectively. You can also reach Ray on the Internet as rgacote@bytepb.byte.com.*

## COMPANY INFORMATION

### Adaptec, Inc.

(1542B SCSI adapter)  
691 South Milpitas Blvd.  
Milpitas, CA 95035  
(408) 945-8600  
fax: (408) 262-2533

**Circle 1320 on Inquiry Card.**

### Corel Systems Corp.

(CorelSCSI)  
1600 Carling Ave.  
Ottawa, Ontario,  
Canada K1Z 8R7  
(800) 836-7274  
fax: (613) 728-9790

**Circle 1339 on Inquiry Card.**

### Disctec

(Disk Technologies Corp.)  
(RoadRunner XD-120)  
925 South Semoran Blvd.,  
Suite 114  
Winter Park, FL 32792  
(800) 553-0337  
(407) 671-5500  
fax: (407) 671-6606

**Circle 1321 on Inquiry Card.**

### Epson America, Inc.

(OMD-5010-100)  
20770 Madrona Ave.  
Torrance, CA 90509  
(310) 787-6300  
fax: (310) 787-5350

**Circle 1322 on Inquiry Card.**

### Image Network Technology

(Infinita 128)  
9661 Telstar Ave., Unit A  
El Monte, CA 91731  
(800) 334-6684  
(818) 454-1617  
fax: (818) 454-1655

**Circle 1323 on Inquiry Card.**

### Iomega Corp.

(Bernoulli Transportable  
90 Pro)  
1821 West 4000 South  
Roy, UT 84067  
(800) 456-5522  
(801) 778-1000  
fax: (801) 778-3450

**Circle 1324 on Inquiry Card.**

### Mass Memory Systems, Inc.

(Disk Pack)  
1414 Gay Dr.  
Winter Park, FL 32789  
(800) 347-5722  
(407) 629-1081  
fax: (407) 628-3862

**Circle 1325 on Inquiry Card.**

### MicroSolutions Computer Products, Inc.

(Backpack)  
132 West Lincoln Hwy.  
DeKalb, IL 60115  
(815) 756-3411  
fax: (815) 756-2928

**Circle 1326 on Inquiry Card.**

### Microtech International, Inc.

(Microtech R50)  
158 Commerce St.  
East Haven, CT 06512  
(800) 626-4276  
(203) 468-6223  
fax: (203) 468-6466

**Circle 1327 on Inquiry Card.**

### Ocean Microsystems, Inc.

(Vista 128)  
246 East Hacienda Ave.  
Campbell, CA 95008  
(800) 262-3261  
(714) 898-1340  
fax: (714) 373-9979

**Circle 1328 on Inquiry Card.**

### Panasonic Communications & Systems Co.

(LF-3000)  
2 Panasonic Way  
Secaucus, NJ 07094  
(800) 742-8086  
(201) 348-7000

**Circle 1329 on Inquiry Card.**

### Peripheral Land, Inc. (PLI)

(Infinity 88)  
47421 Bayside Pkwy.  
Fremont, CA 94538  
(800) 288-8754  
(510) 657-2211  
fax: (510) 683-9713

**Circle 1330 on Inquiry Card.**

### Pinnacle Micro

(PMO-650, REO-130S)  
19 Technology  
Irvine, CA 92718  
(800) 553-7070  
(714) 727-3300  
fax: (714) 727-1913

**Circle 1331 on Inquiry Card.**

### Procom Technology, Inc.

(Floptika 20)  
2181 DuPont Dr.  
Irvine, CA 92715  
(800) 800-8600  
(714) 852-1000  
fax: (714) 852-1221

**Circle 1332 on Inquiry Card.**

### Quantum Corp.

(Quantum Passport XL)  
500 McCarthy Blvd.  
Milpitas, CA 95035  
(800) 624-5545  
(408) 894-4000  
fax: (408) 894-4558

**Circle 1333 on Inquiry Card.**

### Relax Technology, Inc.

(Rewritable Sierra 128)  
3101 Whipple Rd.  
Union City, CA 94587  
(510) 471-6112  
fax: (510) 471-6267

**Circle 1334 on Inquiry Card.**

### Sony Corp. of America

(RMO-S350)  
655 River Oaks Dr.  
San Jose, CA 95134  
(800) 352-7669  
(408) 432-0190

**Circle 1335 on Inquiry Card.**

### SyDOS, Inc.

A Division of SyQuest  
Technology  
(SyDOS 88e)  
6501 Park of Commerce Blvd.,  
Suite 110  
Boca Raton, FL 33487  
(800) 437-9367  
(407) 998-5400  
fax: (407) 998-5414

**Circle 1336 on Inquiry Card.**

### Sysgen, Inc.

(Mobile Disk MD120)  
556 Gibraltar Dr.  
Milpitas, CA 95035  
(800) 821-2151  
(408) 263-4411

**Circle 1337 on Inquiry Card.**

### Trantor Systems, Ltd.

(T338 MiniSCSI host  
adapter)  
5415 Randall Pl.  
Fremont, CA 94538  
(510) 770-1400  
fax: (510) 770-9910

**Circle 1338 on Inquiry Card.**



## REMOVABLE STORAGE

# Mega Drive's 52MB-1.2GB Removable Drives Sizzle and Dazzle

**W**ith a bevy of affordable made in USA products and a relentless pursuit of customer support excellence, Mega Drive Systems, a CA-based company, has become the premier supplier of high performance removable storage in the demanding reliability- and cost-conscious world of corporate and government computing.

This new class of storage products fulfills many of the needs of today's astute MIS managers by combining system reliability, low access time, high throughput, broad compatibility, and versatility. Mega Drive pioneered the removable drive market with a 40MB 3.5" drive in early 1988. Since then, the Company has expanded drive capacities thirty-fold to 1.2GB, added support of 8-, 16- and 32-bit EISA, ISA and MCA buses with a tenfold throughput increase to 10MB/s. and offered Macintosh and numerous Workstation interfaces.

## Mega Drive Removable Applications

These rugged drives range in capacity from 52MB to 1.2GB and are fully compatible with one another, which makes them the ideal choice for data security, RAID, fault tolerant networks, video, prepress and remote computing.

## Where is the Competition?

The numbers speak for themselves. Mega Drive zips along at more than



twice the speed and four times the transfer rate of the "best" cartridge solutions available, it offers up to 30 GB of on-line data with a turbo-charged SCSI-2 architecture, and provides full interchangeability between all drive capacities for an unheard of zero-

cost growth path.

Look At THIS!  
A Superfast Removable Drive from mega Drive.

## MEGA DRIVE REMOVABLES

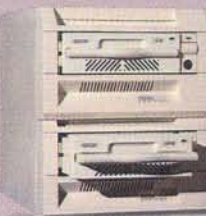
### ■ WHAT HIGH PERFORMANCE REMOVABLES DRIVES DO

Mega Drive's removable hard drives provide high performance, high reliability data in a rugged, palm-sized removable format for security, networking, RAID, video, prepress, and portability applications.

### ■ FEATURES AND BENEFITS

Full range of capacities from 52MB to 1GB per module; full compatibility between capacities; internal and external docking bay availability; SCSI-2 interface; support of PC compatible EISA, ISA, MCA and parallel bus architectures, and Macintosh and major workstations; best access time at 8ms; best transfer rate at 10MB/sec.

## New! Mega Drive's fastest 52MB to 1.2GB removable drives.



• **MEGA SPEED**  
Fast SCSI-2,  
8 ms access, 10  
MB/s. transfer.

• **VERSATILITY**  
52MB to 1GB+  
per module. Up  
to 30GB on-line.

### • MEGA DRIVE APPLICATIONS

Includes security, fault tolerant networks, RAID, remote computing, video, prepress.

Mega Drive Systems, Inc.

489 S. Robertson Blvd. • Beverly Hills • CA 90211  
Tel (310) 247-0006 • Fax (310) 247-8118

Yes! Tell me more about Mega Drive's fast and reliable 52MB-1GB removable drives.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_

ZIP \_\_\_\_\_

PHONE \_\_\_\_\_

**Call Now 1-800-322-4744**

**MEGA DRIVE**  
SYSTEMS™



## HARDWARE

### Fast 486 File Servers

**STEPHEN PLATT, TADESSE GIORGIS,  
LESLIE REISZ, AND STEVE APIKI**

**F**ast, crash-resistant networks depend on many factors: workstation performance, properly managed protocols, and well-placed bridges, to name just a few. Ultimately, however, most network requests will end up at a file server, and most of the data shuffled across the LAN will cross the disk of a server at one time or another. That puts most of the load of your network squarely on the shoulders of a few file servers.

Upgrading or adding additional high-performance servers is especially attractive in these days of rapidly deflating hardware prices. But systems show substantial differences in performance and ease of operation as well as price. For this review, we tested the performance and gauged the configurability of 12 50-MHz 486DX- and 486DX2-based file servers under NetWare and Unix: the Acer America AcerFrame 1000, the Advanced Logic Research PowerPro, the AST Research Premium SE 4/50, the Compaq Systempro/LT, the DEC DECpc 450ST, the Dell 450SE/2, the Everex Step 486DX2/50 EISA Tower, the Gateway 2000 50-MHz 486DX2 EISA, the IBM PS/2 Model 95 XP 486, the NCR 3447, the Northgate 486 EISA DX2, and the Tangent MultiServer. The table details each configuration.

These systems do not, in general, represent the top-performing systems from each manufacturer's line. You can find faster drive array-based systems from each of these vendors or configure your own with third-party hardware; you could also choose top-of-the-line Tricord or NetFrame "superservers." We gathered this group together based on price. These 12 servers are the least expensive machines from major system vendors that met our minimum server criteria for capacity and performance—namely, 1 GB of mass storage, a 50-MHz 486 or 486DX2, and 16 MB of RAM.

#### Testing Servers

We benchmarked these systems at the National Software Testing Laboratory using BYTE's standard Novell NetWare and Unix network benchmarks. These tests break server performance into two basic categories: message passing and file I/O.

Message passing consists of repeated packet transfers between server and workstations; it's a measurement of the throughput of the physical network. For testing file servers, the most relevant numbers are those generated by the file I/O tests. In these tests, workstations open, read, and write files on the server using either sequential- or random-access patterns. The file I/O tests measure true server throughput; disk I/O speed is the most important factor, but processing speed and network I/O performance also contribute. You can find further details of each test in the suite in "File Servers Face Off," February BYTE.

We used Novell NetWare 386 version 3.11 to test all the servers. We equipped each EISA server with two Novell NE3200 32-bit EISA Ethernet adapters, balancing network load across two segments. IBM and NCR supplied 32-bit Micro Channel Ethernet cards for these tests; IBM supplied 3Com cards, and NCR supplied Cogent E/Master III adapters.

Most of the servers ran SCO Unix System V release 3.2.4, but there were a few exceptions. We tested NCR's 3447 with AT&T Unix SVR4, the company's primary Unix version. Neither Tangent's nor Gateway's servers would run release 3.2.4 (they lacked driver support), so we ran these under SCO release 3.2.2. Finally, since IBM's main Unix platform is its RISC System/6000 series, we didn't test the Model 95 under Unix.

Because SCO Unix doesn't currently support Novell's NE3200 (it will in an upcoming release), we used Mylex's LNE-390A as the standard test adapter. Mylex's



drivers don't support dual interface cards, so we were limited to a single segment. Since Cogent's cards don't support Unix, NCR included a Western Digital WD8003 16-bit Micro Channel adapter for the Unix tests.

Twelve 286-based diskless workstations formed our LAN test-bed. Half the workstations were independent units; the other half were constructed from NSTL's LAN-Box, a collection of single-board workstations housed in a single test fixture.

We tested each server with four, eight, and 12 clients in each environment. The figure shows the aggregate throughput for each server for each test (message passing and sequential and random I/O). Note that the figure shows total throughput on the network—that is, the sum of the throughput seen by each client on the network.

#### Performance Considerations

The benchmark figures represent a network "saturation curve" for each type of task and for each server. Each curve starts low, peaks at some median number of



## BYTE ACTION SUMMARY

### ■ WHAT 486 FILE SERVERS ARE

They are 486 systems with high storage capacity and a 32-bit bus for high-speed networking.

### ■ LIKES

Performance of all systems, regardless of price, is roughly equivalent under NetWare. Compaq's and NCR's systems stand out under Unix.

### ■ DISLIKES

ALR's, Gateway's, and Northgate's systems are difficult to configure and maintain.

### ■ RECOMMENDATIONS

For NetWare, the DEC, Dell, and Everex systems provide the best mix of price, performance, usability, and features. Compaq's Systempro/LT and NCR's 3447 are the best machines for Unix.



clients, and then begins to decline. At the lowest levels, all the servers are unsaturated (i.e., used at less than total capacity); you can add additional clients without affecting per-node transmission rate. Once a server is saturated, you can expect total throughput to remain constant while you see a linear, or worse, decay in throughput as seen by each client. Throughput decays further as you add additional clients.

Saturation behavior is critical in determining server performance. Network saturation levels depend on five basic factors: server processing speed, server disk subsystem, server interface card, network substrate, and client performance. Of these, the network substrate and client performance did not limit performance and remained constant for each server, so we'll focus on the other contributing factors.

Naturally, a fast CPU and memory subsystem is more responsive to client requests. Moreover, processing power contributes to faster file I/O in the form of faster cache buffers and request processing. Half of these servers are built around Intel's 486DX2, while the rest use a full

486DX. Yet the top performer on BYTE's NetWare message-passing test is a DX2 machine. This demonstrates that a strong disk/memory and memory/network interface is much more relevant to server performance than whether or not the system is based on a DX2 processor.

Fast disk performance is critical to server throughput. As the number of clients increases, disk and buffer thrashing can occur. Buffers can become filled and then discarded before they are used, if the buffer is needed by another client's operations. Also, disk operations that may be sequential on a per-client basis become effectively random as client operations are intermixed. The majority of these systems use a caching SCSI drive controller and fast hard drives to help enhance performance.

Finally, NIC (network interface card) performance also contributes to the mix. While we tested the EISA systems on the same cards, the Micro Channel machines (IBM's and NCR's) required other NICs. Most notably, NCR's 16-bit NIC limited the 3447's throughput on our Unix tests.

### How They Did

Most of the servers performed similarly under NetWare. Message passing showed the most variation, with Acer's and ALR's systems generally performing best. However, some of the faster systems (the PowerPro and Premium SE 4/50) failed to complete this test when running with 12 clients. According to ALR, increasing message buffers under NetWare solves the problem, but we restricted each server to a common configuration. The NCR 3447 failed to complete the test even at four clients; NCR was examining the problem as we went to press.

On the I/O tests, all the servers show large increases in I/O processing when increasing the load from four to eight clients, and a smaller increase in throughput when the load is increased to 12 clients. This indicates that with a total load of 12 very active clients, some servers remain unsaturated. The random I/O tests show a virtual tie for top performance, although the NCR 3447 trailed the others by a noticeable margin. Ironically, the NCR 3447 easily bested the other systems on sequential I/O.

Unix I/O tests saturated most of the servers, which is indicated by declining performance curves. Compaq's Systempro/LT, with the high-performance IDA-2 array controller, was much faster than the rest of the systems on both Unix I/O tests.

*continued*



## FEATURE COMPARISON — 486 SERVERS

*Price and disk drive capacity are the two most critical points of comparison when looking at server characteristics that don't affect performance.*

	AcerFrame 1000	ALR PowerPro	AST Premium SE 4/50	Compaq Systempro/LT	DECpc 450ST	Dell 450SE/2
<b>Price<sup>1,2</sup></b>	\$13,065	\$14,266	\$12,595	\$15,478	\$8249	\$6770
<b>Processor/memory system</b>						
Processor type	486DX	486DX/2	486DX	486DX/2	486DX	486DX/2
Processor speed (MHz)	50	50	50	50	50	50
RAM <sup>1</sup> (MB)	16	17	16	16	16	16
Maximum RAM (MB)	128	205	80	256	192	128
External cache <sup>1</sup> (KB)	256	256	256	512	0	128
Maximum external cache (KB)	256	512	256	512	128	128
<b>Mass storage</b>						
Total hard drive storage <sup>1</sup> (MB)	1040	1070	1200	1360	1061	1352
Tested configuration	Two 520-MB drives	Two 535-MB drives	One 1.2-GB drive	Four 340-MB drives	One 852-MB drive, one 209-MB drive	One 1.4-GB drive
Total hard drive bays	Seven half-height	Nine half-height	Seven half-height	11 half-height	Five half-height	11 half-height
Hard drive interface	SCSI	SCSI	SCSI	Compaq IDA-2	SCSI	SCSI
Drive controller cache	4 MB	0	4 MB	4 MB	0	0
Floppy drive (MB)	1.44	1.44	1.44	1.44	1.44	1.44
<b>Expansion bus</b>						
Bus type	EISA	EISA	EISA	EISA	EISA	EISA
Number of slots	Eight	Eight	10	Seven	Six	Eight
<b>Peripherals</b>						
Video type	VGA	VGA	VGA	VGA	VGA	VGA
Serial ports	Two	Two	Two	Two	Two	Two
Parallel ports	One	One	One	One	One	One
Mouse port	Yes	Yes	Yes	Yes	Yes	Yes
<b>Power supply capacity (W)</b>	350	300	300	355	254	300
<b>Operating systems</b>						
NetWare version tested	NetWare 3.11	NetWare 3.11	NetWare 3.11	NetWare 3.11	NetWare 3.11	NetWare 3.11
Unix version tested	SCO Unix 3.2.4	SCO Unix 3.2.4	SCO Unix 3.2.4	SCO Unix 3.2.4	SCO Unix 3.2.4	SCO Unix 3.2.4
Novell-certified	Yes	Yes	No	Yes	Yes	Yes
<b>Service/support</b>						
Warranty	1 year	1 year	1 year	1 year	1 year	1 year
On-site service	Optional	Optional	Third-party	1 year	Optional	1 year

<sup>1</sup> As tested.

<sup>2</sup> As-tested price includes configuration listed, without monitor, tape drive, operating system, or network adapter.

The NCR 3447 also ran well, showing no degradation on the sequential I/O benchmark. Unix packet-passing test results were all over the map, but the Systempro/LT, the Premium SE 4/50, and the AcerFrame 1000 stand out as the top performers.

### Low Cost, but a Few Headaches

As we mentioned earlier, price was a key consideration for us in choosing servers. Of these machines, Gateway's was the least expensive, coming in at \$5174; the PS/2 Model 95 was by far the most expensive, at \$19,375. A few very good machines came in at under \$10,000, including the DECpc 450ST, the Dell 450SE/2, the Step 486DX2/50, Northgate's system, and Tangent's MultiServer.

Of course, factors like ease of configuration and expandability are also important in evaluating servers, and that information isn't always easily gleaned from feature tables. What follows is a summary of our experience with each of these machines. We have focused primarily on the problems we encountered while running each system.

### Acer America AcerFrame 1000

We had no problems installing or running Unix or NetWare on the AcerFrame. The machine was extremely easy to work with. Our one nit-picking complaint is that the power switch on our review system was sticky, making it sometimes difficult to use.

### ALR PowerPro

Four 3½-inch disks can be added to a swing-out assembly attached to the main cabinet of the PowerPro. The assembly offers quick access, but we had problems swinging the assembly back into place, as the cables were occasionally hard to reposition correctly.

The PowerPro presented some problems. Our first difficulty was in installing Ethernet cards. When we installed the NICs, the system lost SCSI controller configuration information. The PowerPro required complete reconfiguration of the SCSI controller from the configuration floppy disk. NetWare installation was likewise problematic. We were not able to maintain a bootable DOS partition on the

hard disk with a NetWare partition using both physical disks. We eventually booted DOS from floppy disk and then switched to the hard disk for testing.

### AST Research Premium SE 4/50

The Premium SE's cabinet is rugged, with a smoke-colored clear plastic dust panel covering the drive bays and indicators. The side panel of the cabinet swings back to allow access to the interior.

Installation of both NetWare and Unix was fairly straightforward. Our only installation-oriented complaint pertains to the sluggish EISA configuration utility.

The Premium SE 4/50 ran most of the NetWare tests without problem. But it was unable to complete the 12-client message-passing test. Unix testing ran without problems.

### Compaq Systempro/LT

The Systempro/LT scores points for attention to detail. The external floppy drives are mounted at an angle, easing access and creating a handle when lifting the server. The disk arrays (either two-disk arrays or



## FEATURE COMPARISON — 486 SERVERS

Everex Step 486DX2/50 EISA Tower	Gateway 50-MHz 486DX2 EISA	IBM PS/2 Model 95 XP 486	NCR 3447	Northgate 486 EISA DX2	Tangent MultiServer
\$9537	\$5174	\$19,375	\$10,660	\$6299	\$6980
486DX/2	486DX/2	486DX/2	486DX	486DX/2	486DX
50	50	50	50	50	50
16	16	16	16	16	16
64	64	64	192	128	128
256	64	0	128	128	256
256	64	0	128	256	256
1200	1040	1200	1340	1354	1352
One 1.2-GB drive	One 1.0-GB drive	Three 400-MB drives	Two 670-MB drives	One 1.2-GB drive	One 1.2-GB drive
Eight half-height	Six half-height	Seven half-height	12 half-height	Seven half-height	Six half-height
SCSI	SCSI	SCSI	SCSI	SCSI	SCSI
0	64 KB	512 KB	0	0	4 MB
1.44	1.44	1.44	1.44	1.44	1.44
EISA	EISA	Micro Channel	Micro Channel	EISA	EISA
Six	Eight	Eight	Seven	Eight	Eight
MDA	VGA	VGA	VGA	MDA	MDA
Two	Two	Two	Two	Two	Two
One	One	One	One	One	One
Yes	Yes	Yes	Yes	No	No
250	200	329	294	220	450
NetWare 3.11	NetWare 3.11	NetWare 3.11	NetWare 3.11	NetWare 3.11	NetWare 3.11
SCO Unix 3.2.4	SCO Unix 3.2.2	Not tested	AT&T Unix SVR4	SCO Unix 3.2.4	SCO Unix 3.2.2
No	No	Yes	Yes	No	No
1 year	1 year	1 year	1 year	1 year	1 year
1 year	1 year	Optional	Optional	1 year	1 year

four-disk arrays are available) are mounted in the bottom of the cabinet, adjacent to the SCSI controller. The back of the cabinet has two large cable restraints, which organize complex setups and relieve strain. However, the cutouts for accessing adapter connections in the back are too deep, making it tough to work with thin-net T-connectors.

We had no problems installing either NetWare or Unix. However, the Systempro/LT was the one server we tested that did not allow NetWare and Unix to reside on separate partitions on the same drive. Installing Unix on the Systempro/LT requires committing the entire drive.

### DEC DECpc 450ST

The 450ST's cabinet was one of the smallest of the servers we've seen. It does not have wheels or handles, but its small size and low weight make it easy to move around. However, it's not very expandable, with only one internal and four external drive bays. We installed NetWare and Unix and ran our tests without problems.

### Dell 450SE/2

The 450SE/2 has an excellent case. Of average size, it has wheels and hand-hold points on the front. Cards mount vertically; this places the adapter backplates on the top of the server instead of in the rear. This placement makes accessing the connectors much easier.

Installation of both NetWare and Unix was extremely smooth, and we had no difficulty running our tests.

**I**f you're running  
**Unix, the Compaq  
Systempro/LT  
is a top performer.**

### Everex Step 486DX2/50 EISA Tower

NetWare and Unix worked well on the Step 486DX2/50, but as with other systems using Adaptec's SCSI host adapter, we encountered some minor problems reconfiguring the drivers when reinstalling NetWare. However, once we got through Adaptec's documentation, the server ran quite well.

### Gateway 2000 50-MHz 486DX2 EISA

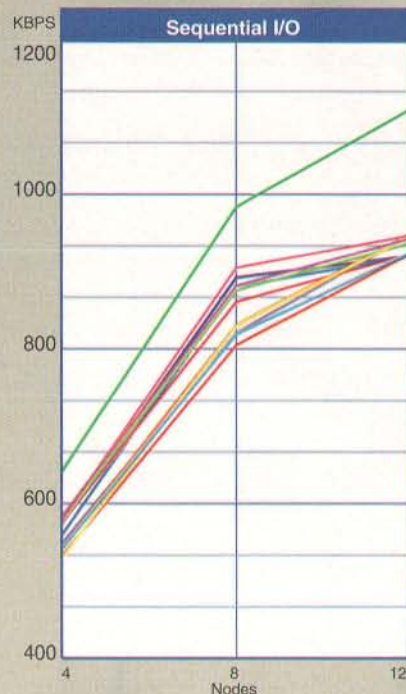
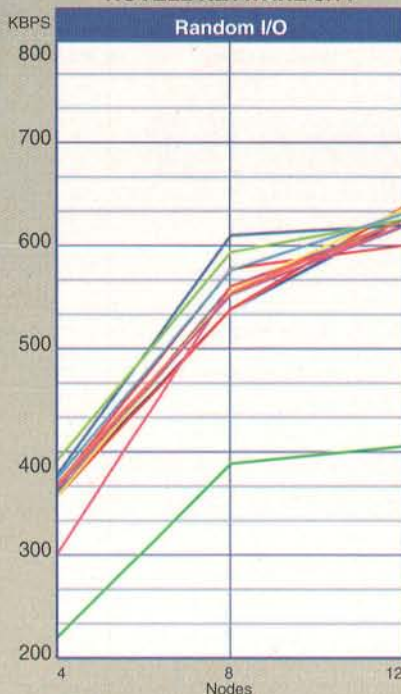
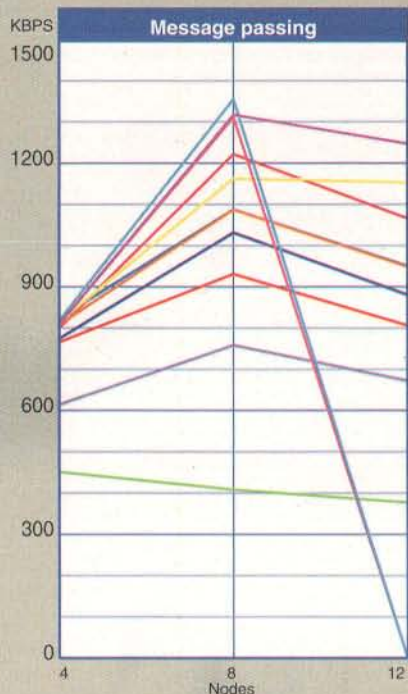
We had trouble with Gateway's system running Unix. The difficulties were with Unix drivers for the drive controller. The drivers Gateway provided would not work with SCO Unix 3.2.4. We spoke to Gateway's technical-support people, but they appeared to be unaware of SCO's latest revision.

We reinstalled version 3.2.2 of SCO Unix and ran the disk drivers with the earlier release. Although the operating system then installed cleanly, an early test crashed the server. Upon rebooting, we discovered that the test data file system

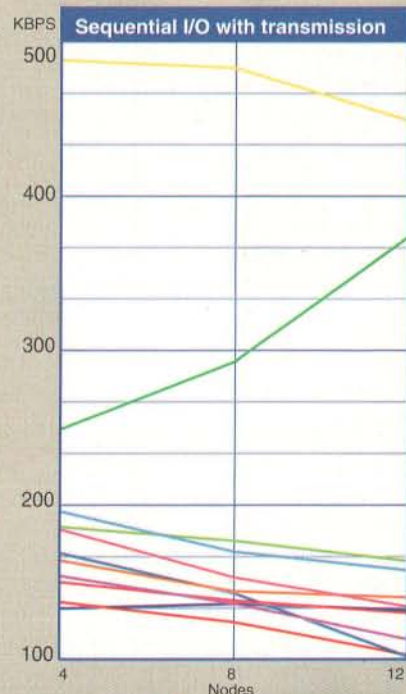
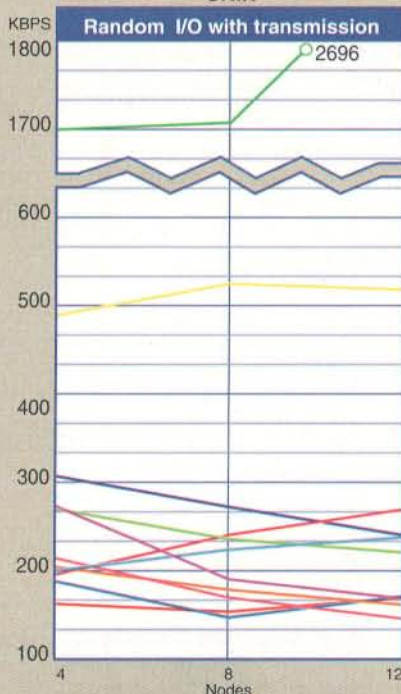
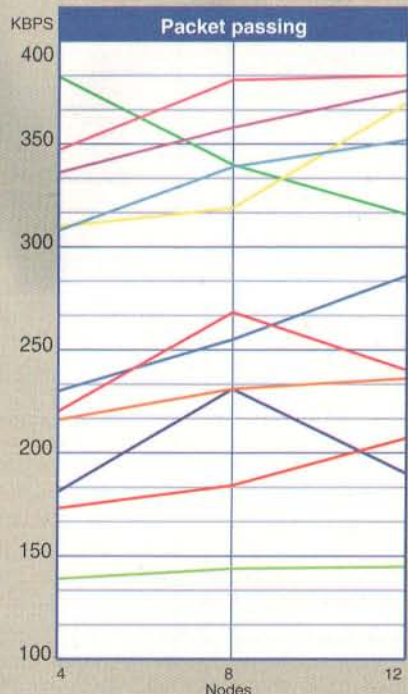


## BYTE NETWORK BENCHMARKS

## NOVELL NETWARE 3.11



## UNIX



AcerFrame 1000  
ALR PowerPro  
AST Premium SE 4/50

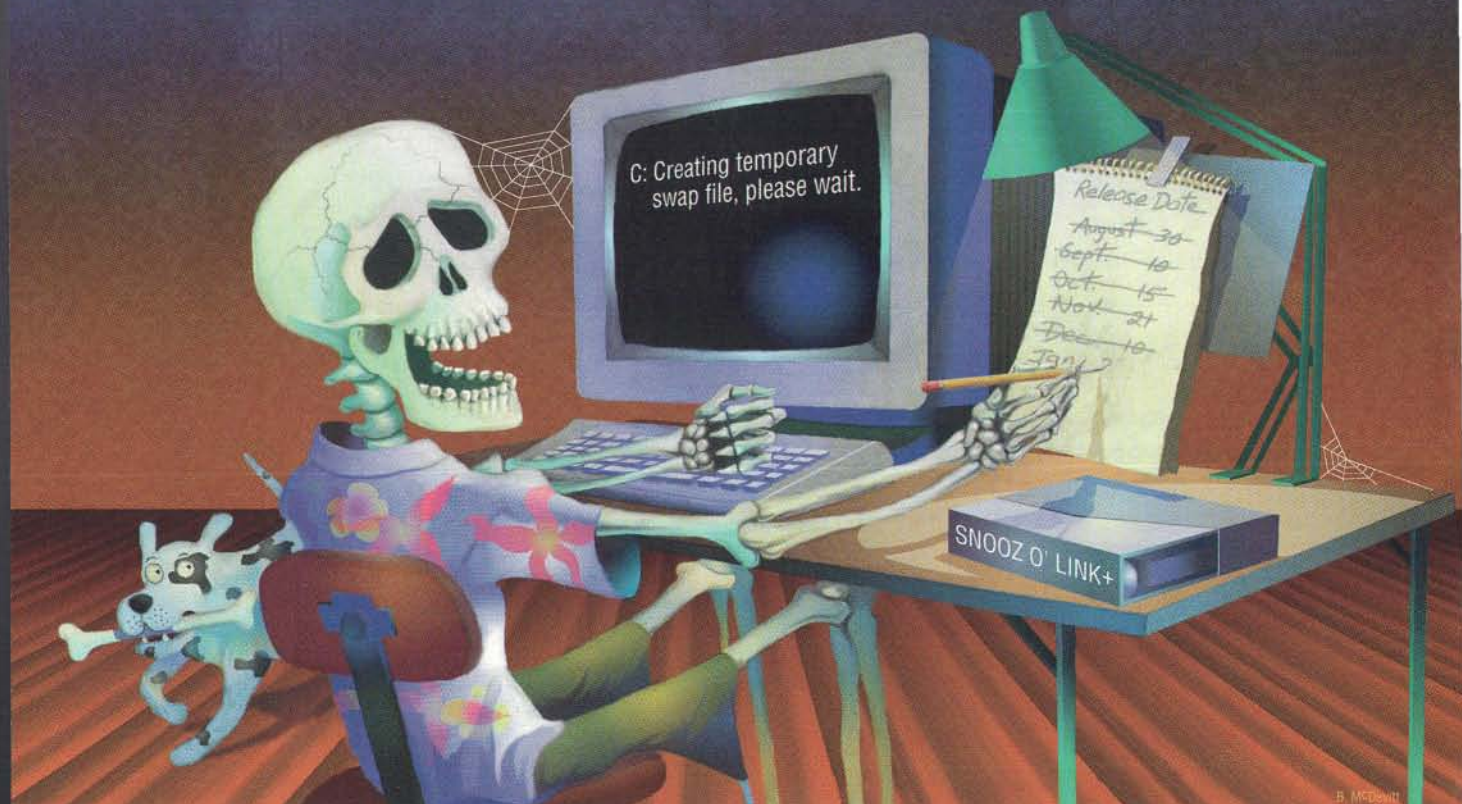
Compaq Systempro/LT  
DECpc 450ST  
Dell 450SE/2

Everex Step 486DX2/50 EISA Tower  
Gateway 50-MHz 486DX2 EISA  
IBM PS/2 Model 95 XP 486

NCR 3447  
Northgate 486 EISA DX2  
Tangent MultiServer

NetWare benchmark results show very similar performance among servers, regardless of price or configuration. Many of these servers remain unsaturated even with 12-client loads. Unix benchmark results show that saturation occurs for most servers at less than 12 clients. On these tests, Compaq's Systempro/LT and NCR's 3447 turned in the best performance results.





# How much longer can you afford to wait?

## Create Overlaid Programs-Fast.

BLINKER™, the world's first and fastest dynamic overlay linker, reduces your link time to seconds and reduces program memory requirements. Now you can use one linker for all your software projects.

## One Linker, Many Languages.

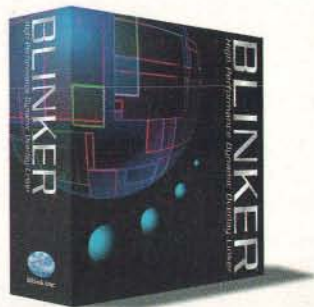
BLINKER 2.0 links and automatically overlays DOS programs written in Microsoft® C, BASIC, Assembler, QuickBASIC™, Fortran, Pascal, Watcom™ C, Zortech® C++, Clipper®, FORCE® and in Borland® C, C++, Assembler, and more.

## Save Time and Memory.

BLINKER removes the need for overlay structures, simplifies program design and reduces memory requirements to save you time, effort and memory.

## Memory Swap Function.

BLINKER is the ONLY linker to offer an integrated memory swap function, so you can run other large programs from within your program, with negligible memory overhead.



**BLINKER™**  
High Performance Dynamic Overlay Linker

## Don't Settle for Less.

Other major features include full CodeView® support, use of EMS/XMS at program run time, and enhanced execution speed of overlaid code.

## Time is Money.

BLINKER offers all this in a fraction of the time it takes to link with your current overlay linker. You know time is money, and link time is no exception.

## Free Demo

To try our free demo on your own code



**Call: 804-355-4444** or  
**FAX: 804-355-1676**

## Order now!

If you can't wait any longer, we offer a risk free 30 day money back guarantee. Available in 5.25" or 3.5" diskette format.

**Price \$299**  
plus shipping & handling



**Blinkinc**  
P.O. Box 7154  
Richmond VA  
23221



had been completely corrupted and had to be rebuilt. We re-created it as a smaller (less than 300-MB) partition, and then all tests ran smoothly.

## IBM PS/2 Model 95 XP 486

This server is compact and well designed. Modular construction of the major parts makes installation and removal of individual components quite easy.

DOS and NetWare came preinstalled on the system, as did two 3Com Micro

Channel 32-bit Ethernet cards. We easily completed all the NetWare benchmarks. Unfortunately, after completing the tests, the server started behaving erratically. Upon booting, we would receive the message "Processor card changed—00169." Sometimes, additional "Not OK—Call IBM" icons would also appear. In spite of repeated execution of the configuration utilities (including complete system tests), we couldn't completely eliminate this intermittent problem.

## NCR 3447

At 29 inches, the 3447 doesn't fit under every table, but it is sturdily constructed, and it has ample room for additional devices, and wheels for easy transport. Our only real complaint about the chassis is its power interlock switch; you can't turn the system on with the case open. Although it's a nice safety feature, it effectively prevents debugging and testing of new hardware without jamming the switch open.

We installed and ran NetWare using two Cogent E/Master III 32-bit Micro Channel Ethernet interface cards. However, the actual tests proved more difficult to run on the 3447 than on any other server. Many of the benchmarks froze one or more clients, and we were unable to get the message-passing tests to run at all.

## Northgate 486 EISA DX2

Northgate's machine presented problems running both NetWare and Unix. After we ran the EISA configuration utility and installed NetWare, the system failed to come up due to a "failed initialization of firmware." The system was particular about reconfiguration and occasionally lost configuration information when we attempted to modify other parts of the system.

Northgate didn't ship Unix drivers for the SCSI controller, so we called technical support. Ciprico, the host adapter's manufacturer, ended up shipping these drivers. After we completed the Unix installation, the Unix benchmarks crashed the operating system, destroying our data partition. This created a completely unrecoverable file system, and we needed to rebuild the entire Unix partition. After a few tries, we were able to run the benchmarks successfully.

## Tangent MultiServer

Like Northgate's system, the MultiServer was finicky about the EISA slots used for the adapter cards, and we had to juggle them a bit to get the system running. However, once we got NetWare installed, the system ran without notable problems.

Drivers for the Mylex SCSI adapter for SCO Unix 3.2.4 have not been released, so we ran our Unix tests under SCO 3.2.2. We had no problems installing the operating system or device drivers, and, after installation, the tests ran quite smoothly.

## The Best Servers

If you're running Unix, the Systempro/LT is an obvious top performer, followed by the NCR 3447. If you're running NetWare, performance choices are not that clear-cut, and you'll have to make a selection based on other criteria.

After working extensively with each of these servers, we'd select five systems as



## The Smart-UPS™

by American Power Conversion



Smart-UPS 400  
(11/90)

APC Uninterruptible Power Supplies keep more LANs up, running, and reliable than any other brand of UPS. Call for your free power protection handbook and find out why.

### APC Europe

4, Rue Ste Claire Deville  
ZAC du Mandinet Batiment Espace  
Lognes 77447 Marne La Vallee  
Cedex 2, France  
Phone: 33 (1) 6017-8400  
Fax: 33 (1) 6017-8029

In US: (800) 800-4APC, Dpt. A2

In Latin America: (401) 789-5735

Fax: (401) 789-1631

### Advanced features

- Tracks power quality data for analysis (software required)
- Interface for Novell, LAN Manager, LAN Server, Unix, Banyan, etc.
- SmartBoost™ brownout correction
- Full-time multi-stage surge suppression, EMI/RFI filters
- Battery replacement LED, load and voltmeters
- 400 to 2000VA in both 117V and 220/240V models

### Unmatched reliability

- 1986, 1990 PC Magazine Editor's Choice
- 1989, 1990 Reseller Management "Best to Sell UPS"
- 1990, 1991 LAN Times, Readers' Choice
- 1989 PC Week, "All Around Reliable Choice"
- 1990 InfoWorld, "Value Leader"
- 1990 Systems Integration, Product of the Year
- 1991 Byte Magazine, Best UPS for LANs



# BUFFALO®

## Complete Network™

Photo by Gary Windersgild

**All the Hardware.**

**All the Software.**

**All from One Source.**

### Industry Standard Hardware

Complete Network has Intel® EtherExpress16™ LAN Adapters for your network connections. Installation is easy because the cards are totally software configurable and automatically adjust for 8 or 16 BIT card slots. These Plug 'N' Forget™ cards from Intel set the standards for Ethernet LAN adapters.

### High Performance Software

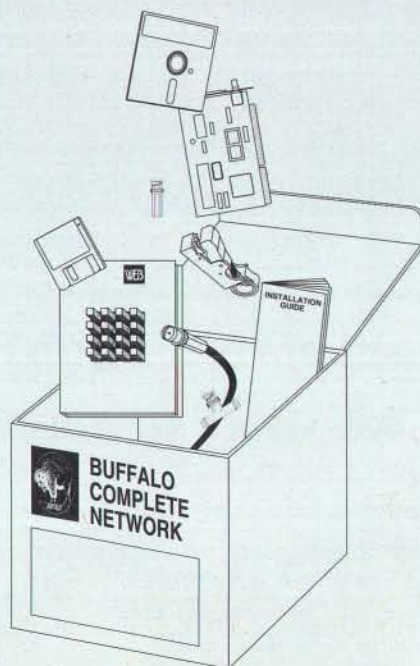
Complete Network features the WEB® 3.0 Network Operating System, winner of the LAN Times 1992 Best of Times award. WEB 3.0 is a fast and flexible system which is simple to learn and easy to use. It supports DOS and Windows™ and is Novell® compatible. WEB 3.0 provides the first peer-to-peer network to equal or exceed the performance of most dedicated server based systems.



**WEB® LICENSED TECHNOLOGY**

### Everything Else You Need

Complete Network has everything else you need to set up your network: cable, connectors, terminators, and even a cable stripping tool.



### Toll-Free

### Complete Technical Support

Buffalo provides technical support for all the hardware and software of your Complete Network. You only need to make one contact for support for any part of your network system.

### Easy Installation

An easy installation guide helps you quickly and easily set up your Complete Network

### Just the Nodes You Need

With the Complete Network you can start with any number of nodes and add any number of nodes to your network at any time. Combine any of these packages, up to 255 nodes, to fit your needs.

CN-2	2 Node Package	\$395.00
CN-5	5 Node Package	\$995.00
CN-10	10 Node Package	\$1,895.00
CN-15	15 Node Package	\$2,795.00
CN-30	30 Node Package	\$4,995.00
CN-A	Add-A-Node Package	\$225.00

### 45 Day Money-Back Guarantee

US and Canada Toll-Free

**1-800-345-2356**

FAX (503) 585-4505

Buffalo Products, Inc.

2805 19th St. SE, Salem, OR 97302-1520

Response Code: A2CN3

France - 01-4827-6736; Germany - 08152-7912-(0)-50,  
02241-66071; Italy - 02-261-0051; Belgium - 016-400416;  
Denmark - 42-95-3888, 38-89-0909;  
Finland - 0-351-5055, 0-803-6033; Netherlands -  
073-440700; Norway - 2-214-050; Hong Kong - 861-2112;  
Korea - 02-783-5344; Israel - 3-560-3837;  
International - 81-45-681-5401

Complete Network is a trademark of Buffalo Products, Inc. Buffalo is a registered trademark of MELCO, Inc. WEB is a registered trademark of WEBCORP. WEBCORP is a trademark of WEBCORP. INTEL is a registered trademark of INTEL Corp. Other brands and product names are trademarks or registered trademarks of their respective owners.

**Circle 399 on Inquiry Card.**



## COMPANY INFORMATION

**Acer America Corp.**

(AcerFrame 1000)  
2641 Orchard Pkwy.  
San Jose, CA 95134  
(800) 733-2237  
(408) 432-6200  
fax: (408) 432-6221

**Circle 1230 on Inquiry Card.**

**Advanced Logic Research, Inc.**

(PowerPro)  
9401 Jeronimo Rd.  
Irvine, CA 92718  
(800) 444-4257  
(714) 581-6770  
fax: (714) 581-9240

**Circle 1231 on Inquiry Card.**

**AST Research, Inc.**

(Premium SE 4/50)  
16215 Alton Pkwy.  
P.O. Box 19658  
Irvine, CA 92713  
(800) 876-4278  
(714) 727-4141  
fax: (714) 727-9355

**Circle 1232 on Inquiry Card.**

**Compaq Computer Corp.**

(Systempro/LT)  
P.O. Box 692000  
Houston, TX 77069  
(800) 345-1518  
(713) 370-0670

**Circle 1233 on Inquiry Card.**

**Dell Computer Corp.**

(450SE/2)  
9505 Arboretum Blvd.  
Austin, TX 78759  
(800) 289-3355  
(512) 343-3653  
fax: (512) 338-8700

**Circle 1235 on Inquiry Card.**

**Digital Equipment Corp.**

(DECpc 450ST)  
305 Foster St.  
Littleton, MA 01460  
(800) 722-4330  
fax: (800) 524-5694

**Circle 1234 on Inquiry Card.**

**Everex Systems, Inc.**

(Step 486DX2/50 EISA Tower)  
48431 Milmont Dr.  
Fremont, CA 94538  
(800) 821-0806  
(510) 498-1111

**Circle 1236 on Inquiry Card.**

**Gateway 2000**

(50-MHz 486DX2 EISA)  
610 Gateway Dr.  
North Sioux City, SD 57049  
(800) 523-2000  
(605) 232-2000  
fax: (605) 232-2023

**Circle 1237 on Inquiry Card.**

**IBM Corp.**

(PS/2 Model 95 XP 486)  
1133 Westchester Ave.  
White Plains, NY 10604  
(800) 426-9292

**Circle 1238 on Inquiry Card.**

**NCR Corp.**

(NCR 3447)  
Workstation Products Division  
1700 South Patterson Blvd.  
Dayton, OH 45479  
(800) 225-5627  
(513) 445-2078

**Circle 1239 on Inquiry Card.**

**Northgate Computer Systems, Inc.**

(Northgate 486 EISA DX2)  
7075 Flying Cloud Dr.  
Eden Prairie, MN 55344  
(800) 548-1993  
(612) 943-8181  
fax: (612) 943-8336

**Circle 1240 on Inquiry Card.**

**Tangent Computer, Inc.**

(MultiServer)  
197 Airport Blvd.  
Burlingame, CA 94010  
(800) 466-3300  
(415) 342-9388  
fax: (415) 342-9380

**Circle 1241 on Inquiry Card.**

the most flexible, the most stable, and the easiest to install and maintain. Exclusive of performance, the Compaq Systempro/LT is the best, followed by the DECpc, the Dell 450SE/2, the Everex Step system, and the IBM PS/2 Model 95. Of course, price needs to enter into the process as well. DEC (yes, DEC), Dell, Northgate,

Tangent, and Gateway win on that basis.

Overall, we prefer the DEC, Dell, and Everex systems as NetWare servers. For Unix, we recommend the Compaq Systempro/LT and the NCR 3447 if they fit within your budget. If you need a less costly Unix server, check out the Tangent MultiServer. ■

*Stephen Platt, Tadesse Giorgis, and Leslie Reisz evaluate systems and networking products for the National Software Testing Laboratory (Plymouth Meeting, PA). You can contact them on BIX c/o "editors." Steve Apiki is a BYTE technical editor; you can reach him on BIX as "apiki" or on the Internet at apiki@bytepb.byte.com.*

## Subscription Problems?

### We want to help!

*If you have a problem with your BYTE subscription, write us with the details. We'll do our best to set it right. But we **must** have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible.*



**BYTE**

Subscriber Service, P.O. Box 555, Hightstown, NJ 08520





# 486-B<sup>2</sup>T

## 486/860 Speed... Microway Quality.

Microway has engineered four distinctive black tower systems. The **486-B<sup>2</sup>T** is designed for high-end users. It comes standard with American 486 motherboards and power supplies, yet has a reasonable starting price of \$2,195. A broad range of options can be installed including high speed and capacity hard disks, intelligent serial controllers, tape back-up units, high end graphics adapters and our *Number Smasher-860*. These systems are ideal for configuring Novell or UNIX file servers, multiuser systems, and workstations for graphics, CAD and scientific uses. The **486-B<sup>2</sup>T** comes with dual fans, *Across the Board™* Cooling and American industrial grade power supplies. All systems are thoroughly tested, burned in and include the best technical support in the industry, which we've provided since 1982.



**Number Smasher-860**

The key to attaining workstation performance is Microway's 40MHz *Number Smasher-860*. It features a four-way interleaved 64-bit memory system that runs at 160 megabytes/sec. The *Number Smasher's* i860 has been clocked at 80 megaflops doing matrix multiplies, 67 megaflops doing FFTs and 11.8 Double Precision Linpack Megaflops on large arrays—ten times the speed of a 486 and twice the speed of a Cray 1F! One happy user recently reported that his "Baby Cray" was happily humming away saving him thousands of dollars per month in 3090 rentals. The *Number Smasher* comes with the finest i860 compilers on the market, your choice of Microway's NDP™ FORTRAN, C/C++ or Pascal.

**Call or write today for more information on Microway's new black tower systems.**

# Microway®

Corporate Headquarters, Box 79, Kingston, MA 02364 USA • TEL 508-746-7341 • FAX 508-746-4678 • U.K./Europe 081-541-5466  
France 01 43 2 69593 • Germany 069-75-2023 • Holland 40 836455 • Italy 02-74.90.749 • Japan 0474 23 1322 • Norway 6-892020

Circle 132 on Inquiry Card.



The Intel Inside Logo is a trademark of Intel Corporation.

**Technology You Can Count On**





# JUST HOW FAST IS PROGRAMMING IN APL★PLUS?

This fast. APL★PLUS streamlines the whole programming process and screams through complex data manipulations with turbo speed.

APL★PLUS notation is like the math you already know. So you can solve problems the way you think about them, instead of wasting time figuring out *how* to solve them. And it's concise. A few lines of APL★PLUS can replace pages of code written in other languages.

Explore complex "what if" scenarios using built-in functions that manipulate tables of data like single objects. Prototype solutions and quickly put them to the test. Develop complete applications in record-breaking time with editing, graphics, screen windowing and communications facilities, mouse support and interfaces to spreadsheets and subroutines written in other languages.

Use our tutorial to jump start the whole programming process. Then, use APL★PLUS' speed and power to zoom through your development cycle so fast it's almost illegal. APL★PLUS. The programming language to use when you have miles of data. And the need for speed. Call today and we'll rush you a *free* demo disk.

## APL★PLUS®

(800) 592-0050 Ext. 875

In Maryland (301) 984-5123

APL★PLUS is a registered trademark of Manugistics, Inc., and is available for IBM PC's and compatibles, UNIX workstations, VAX minicomputers and IBM mainframes. Fax: (301) 984-5094 TELEX: 898085 (STSC ROVE) © 1991 STSC, Inc. Germany: 069-80053-0/0212-33-90-99; France: 01-45-27-20-61; U.K.: 071-436-9481; Canada: 416-369-1630; Spain: 01-556-6056. All other countries, call (301) 984-5412 for the name of a local dealer.

**Circle 446 on Inquiry Card.**



## APPLICATION

## CorelDraw 3.0: A Swiss Army Knife for Illustrators

G. ARMOUR VAN HORN

When I opened the CorelDraw 3.0 box, I almost expected a kitchen sink to fall out. The new release of one of the premier Windows illustration packages includes more than just a few new features. Corel has put together a bounty of fonts, clip art, and even complete stand-alone applications. In addition to the upgrade of the original illustration program, the visual catalog program Mosaic, and CorelTrace (see screen 1), CorelDraw 3.0 comes with an image-editing program (CorelPhoto-Paint), a charting module (CorelChart), and a slide-show application (CorelShow).

This release is an extremely powerful offering, marred occasionally by interface quirks and an insistence on doing things its own way. But, in the end, you get a remarkable value for \$595.

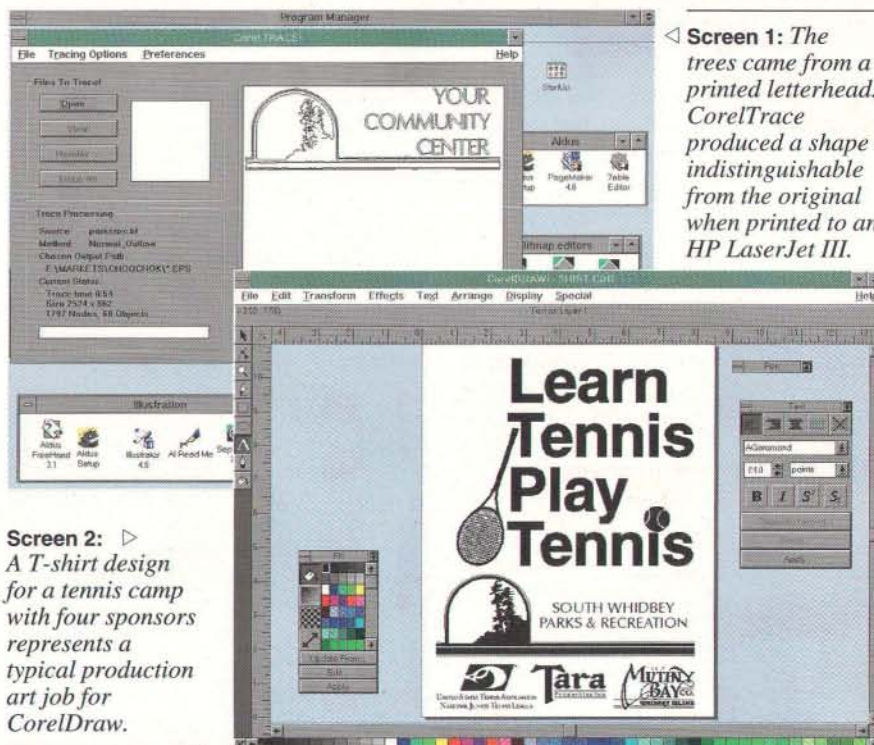
## Look and Feel

I expect that the users of CorelDraw 3.0 will be businesspeople who want to use one of the high-end word processors now available under Windows and only one additional product. This version of CorelDraw adds enough features to support this audience.

The screen layout is comfortable for Windows users; the menu bar is across the top of the screen, the toolbox down the left, and a color palette across the bottom. A status bar immediately below the menu bar indicates most attributes of the current selection: its size, location, outline and fill, font, and what layer it is on. Optional rulers display across the top and left of the drawing area, and visible guidelines can be drawn out from the rulers.

The toolbox displays nine tools in a vertical array, but several of these have "fly-outs" with alternatives. For example, selecting the Freehand Pencil tool brings up options for both polyline and Bézier drawing, unless a bit map has been placed in the drawing and is currently selected, in which case the only option is the auto-trace tool. This approach keeps the screen free of clutter.

Corel introduces roll-up menus in this version, which brings additional power to the screen without taking up too much space. Each of the seven different roll-ups includes a variety of functions, such as line thickness, start and end arrows, line



◀ Screen 1: The trees came from a printed letterhead. CorelTrace produced a shape indistinguishable from the original when printed to an HP LaserJet III.

Screen 2: ▶ A T-shirt design for a tennis camp with four sponsors represents a typical production art job for CorelDraw.

type, and colors on the Outline roll-up. A single click will reduce the floating palette to nothing more than the title bar and control box, making this probably the least intrusive use of floating palettes available.

## Tools of the Trade

Corel continues to use two pointer tools. The Pick tool allows a selected object to be moved, stretched, or scaled; double-selected objects can be rotated or skewed. The Shape tool allows for manipulating points within objects, Bézier control handles, and the spacing within text blocks. Points are modified, joined, or deleted by double-selecting a point or points. Double-clicking on any of the points will call up the point-editing palette as close as possible to the mouse location.

The Zoom tool allows you to move in to inspect details by selecting the magnifier tool and dragging a marquee around the area of interest. This can be repeated indefinitely. My system—a National Designs Volante TIGA board and an NEC MultiSync 3 monitor—let me zoom to fill my screen with about  $\frac{1}{8}$  inch by 1 inch of my drawing. The Show All Objects option draws the screen at the highest magnification that fits all objects on-screen,

helping you find those intermediate or temporary objects that seem to end up around the perimeter of any drawing.

In previous versions of the program, you had to work in wireframe mode and switch to preview mode to view a drawing. CorelDraw 3.0 lets you edit directly from preview mode, although working in wireframe mode is much faster.

## Fun with Fonts

The text tool has options for entering text or symbols. Text can be entered directly on-screen or through a dialog box; the trade-off is feedback versus speed. In general, 3.0 feels much snappier than earlier versions of the program, but sluggish performance is still a major problem when it comes to text redraws.

The symbol entry allows you to select from a wide variety of symbols that have been created by Corel: arrows, bullets, an artichoke from the food font, or a conference room table from the floorplan font. Corel recognizes the standard Windows Symbol character set in this dialog, as well as the Lucida Bright Math extensions from the Microsoft TrueType Font Pack. Procedures for creating additional symbol sets, as well as complete alphabets in either



TrueType or Adobe Type 1 formats, are clearly spelled out in the documentation.

Font support represents a major enhancement to the program. Previous versions required a proprietary font format. If you needed Garamond in illustrations and page layouts, you would require a complete set of fonts in WFN format for use in Corel and the same fonts in Adobe Type 1 or other format for use in other applications. Corel now recognizes Adobe format and TrueType as well as the WFN format.

Text-handling options include a spelling checker and thesaurus.

## Features and Fillers

A clever feature for an illustration program is the Print Merge function, which allows merged data to assume all the text attributes of the field names placed in the original. Anyone responsible for issuing

certificates for corporate training programs is going to love this, except that the data file uses pairs of backslashes as separators instead of the more common comma-delimited format.

The Fill menu includes checkerboard fills, solid colors, fountain fills, and custom PostScript fills. Several PostScript fills are included with the program, with appropriate warnings that their use may slow or disable printing. The tool for positioning offset radial fills will be a major help to those who don't need such features every day, being much more intuitive than the clipping path or paste-inside process that other software demands.

The distortion options that Corel was known for in earlier versions remain essentially unchanged. The Perspective command allows you to generate 2-D art in a straightforward manner and distort it to simulate viewing from an angle other than directly in front of the art. I have used this feature to simulate the appearance of a sign on a building from the perspective of approaching vehicles.

Illustrations are automatically saved periodically, about every 10 minutes. I have come to depend on automatic saves in Microsoft Word for Windows, and I have lost enough illustration work over the years to appreciate the feature.

## The Turn-Around Test

I used Corel to work on a typical production art job, in this case a T-shirt design for a tennis camp with four sponsors (see screen 2). As is typical in real-world illustration work, the art assignment came in with a couple of pieces of good clean art, several verbal suggestions, and a sketch on the back of an envelope.

The large text, racquet, and ball were submitted as a very clean stat (i.e., well-defined lines and no smudges or marks). I scanned the image and used CorelTrace to generate vector information. In the interest of speed, I replaced the text with Helvetica Bold, but I used the tracing output for the racquet and ball. Tracing the 312-KB TIFF file caused CorelTrace to crash with a General Protection failure. Corel technical support suggested that 5.8 MB of temporary file area might not be sufficient. It worked when 7 MB were available. The documentation claims that files up to 3000 by 3000 pixels can be processed by CorelTrace, but my experience suggests that this would take as much as 30 MB of temporary file space. The file was traced in a reasonable 50 seconds on a 20-MHz 386 with 8 MB of RAM.

The windswept trees came from a printed letterhead, and the black image was anything but solid. In this case, I used

CorelPhoto-Paint to eliminate voids in the black of the logo. Tracing with the auto-trace tool in CorelDraw was very disappointing, but a CorelTrace conversion of the file provided a shape that was indistinguishable from the original when printed to a Hewlett-Packard LaserJet III. After tracing, the lines were replaced by vector elements in CorelDraw.

The tennis logo in the lower left was supplied in very clean form, and the interior of the logo and the type both traced cleanly. The outside of the logo shape traced jaggedly, and I could discover no explanation. I drew a rectangle, round-cornered it, skewed it to the right, and then combined it with the internal elements from the trace. This gave me a perfectly shaped logo.

The Tara Properties logo I had previously done in Aldus FreeHand. I opened the original file, copied the logo, and pasted it into the SHIRT.CDR file easily.

Finally, the Mutiny Bay Co. logo was an EPS file on the Macintosh. CorelDraw imported the logo but displayed nothing. Switching to wireframe mode showed that the entire image had been imported successfully, but all fills and lines had been changed to white.

In the real world, artists don't give hours of careful attention to a single image. It just doesn't work that way. Most of us get a handful of scraps and a demand for a proof in a day's time. Corel's tools acquitted themselves very well in this situation, demonstrating quality images, ease of use, and good connections to other software.

## Working Together

The other elements of the program are not particularly integrated with the main drawing program, a discovery that left me with mixed feelings. I would welcome anything that could make the separate elements work together more readily, but additional integration might make it more difficult to use other applications, such as PhotoStyler instead of CorelPhoto-Paint, for those who need the extra power. Each module works well enough with the others through the Clipboard, OLE facilities of Windows, and common file formats.

The other program elements don't share all of CorelDraw's interface features, but enough commonality is maintained that you won't get lost moving from one to another. The zoom tools in CorelChart and CorelPhoto-Paint are limited to preset magnifications, for example.

CorelChart includes the vast majority of charting tools that anyone could want, and it also imports data from ASCII text files, dBase data files, Lotus or Excel

## BYTE ACTION SUMMARY

### ■ WHAT CORELDRAW 3.0 IS

A feature-rich illustration package with bit-map editing, bit-map tracing, charting, presentation, and image-cataloging programs.

### ■ LIKES

It delivers advanced graphics tools at a price far below those of competing solutions, and it does a good job integrating with Windows and other graphics software.

### ■ DISLIKES

Text handling is slow; cannot open multiple files.

### ■ RECOMMENDATIONS

Although graphics professionals still may need several stand-alone applications, many Windows users can't beat CorelDraw for an all-in-one solution. A great value.

### ■ PRICE

\$595

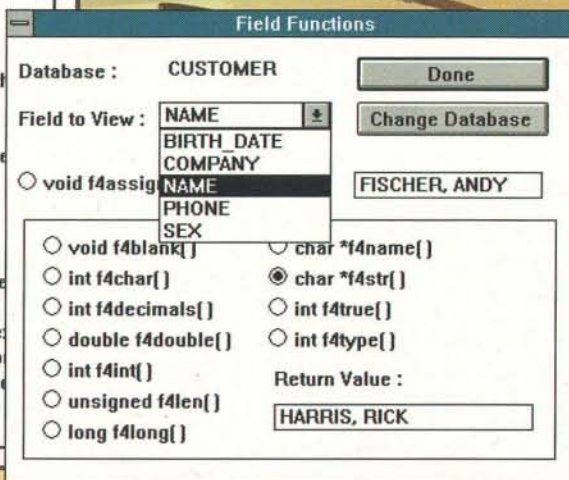
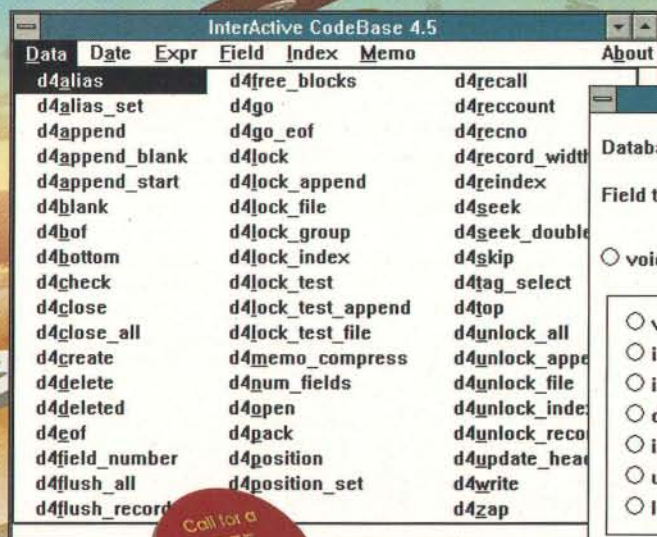
### ■ FOR MORE INFORMATION

Corel Corp.  
1600 Carling Ave.  
Ottawa, Ontario,  
Canada K1Z 8R7  
(613) 728-8200  
fax: (613) 728-9790

Circle 1228 on Inquiry Card.



# dBASE, FoxPro and Clipper in C, C++ and Basic



Call for a  
**FREE**  
Interactive  
CodeBase 4.5

- Multi-user
- DOS, Unix, OS/2 Support
- C++ Interface Included
- Windows 3 Data Entry
- Clipper → C Translator Available

Complete DBMS for C, C++ and VB programmers - compatible with the data, index and memo files of dBASE III/IV, FoxPro 2 and Clipper. Try the super-fast, super-small FoxPro 2.0 CDX index files!



(Using Visual Basic? Try CodeBasic!)

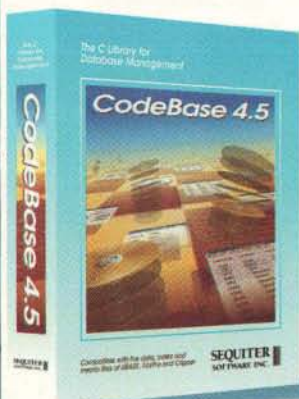
## CodeBase 4.5

The C Library for DataBase Management

**SEQUITER**  
SOFTWARE INC.

TEL. 403•437•2410  
FAX 403•436•2999  
Europe 33.20.24.20.14

#209,9644-54 AVE., EDMONTON, AB, CANADA T6E-5V1





spreadsheet files, and Harvard Graphics chart format. Eighty chart types are listed in the manual, including a vertical and horizontal bar, line and area charts, 3-D charts, pie charts, scatter charts, high-low-open-close, and histograms.

CorelPhoto-Paint is a repackaged version of ZSoft's PhotoFinish. It accepted all the bit maps I offered it, of both PC and Macintosh origin. CorelPhoto-Paint does the expected painting tasks with somewhat more grace than Windows Paint, offers useful photo-retouching tools, and easily did the bit-map touch-up, cropping, and resizing that I needed while working with CorelDraw and CorelTrace. There is no direct support for scanning.

CorelShow is an OLE client application that functions as an on-screen slide projector. It lets you use objects from any OLE server application, including CorelDraw, CorelChart, and CorelPhoto-Paint, as well as other programs such as Excel and Word. The only image-editing options are positioning and resizing; all other editing is done in the source application. CorelShow offers 22 transition effects, including cell dissolves, wipes, zooms, blinds, and curtain transitions. Corel is offering a run-

time module that will allow you to distribute slide shows without requiring CorelShow on the destination machine.

Mosaic is a catalog utility for graphics files and maintains thumbnail images of your illustrations, bit maps, and clip art. A little time storing your files will eliminate much time wasted opening several similarly named files when you're seeking one particular image.

Corel has taken a leading position in the use of CD-ROM drives on the PC, so it is no surprise that it has one of the first interfaces to Kodak's Photo CD product. Mosaic will display the images on the CD-ROM, and CorelPhoto-Paint will open them.

### The All-in-One Alternative

Corel's installation procedure was smooth, filling about 30 MB of disk space from 10 high-density 3 1/2-inch disks. The installation instructions in the manual would be more helpful if the space requirements for various options were spelled out. A CD-ROM disk is included in all packages that includes the contents of the floppy disks as well as an additional 100 fonts and substantially more clip art.

Documentation consists of a single volume of about 800 pages, on-line help from all programs, a 54-minute VHS video tour of the software's features, and a poster that shows the included type faces.

The largest remaining shortcoming for CorelDraw is its inability to open multiple files. While generating the sample artwork, I created three or four separate files, all of which would have been open at the same time if I had been working in either Adobe Illustrator or Aldus FreeHand.

Graphic arts professionals will probably continue to choose individual programs rather than the Corel collage. Experienced illustrators, in particular, will probably find no reason to switch from Illustrator or FreeHand. But corporate users will appreciate the ability to perform virtually all their graphics operations (other than page composition) in the Corel suite. A single purchase can cover a lot of needs. The total value is exceptional; no other single illustration package on the market today can match it. ■

*G. Armour Van Horn is a writer and a graphics consultant. He can be reached on BIX as "vanhorn."*

# Move Up to 3D at a 2D Price.

## Scale New Heights In Animation with 3D Workshop.



3D WorkShop leaps a giant step ahead in 3D animation for PC's. It delivers on-screen motion and surprisingly fast rendering on any engine, from 286 without a co-processor to full power 486.

Create your own models with 3D WorkShop or import them from AutoDesk™3DS or DXF files. Make your moves effortlessly using 3D WorkShop's four-view universe

and unique Multi-Path™ technology.

Perfect for dynamic business presentations, studio-level music videos and commercials, cartoons, storyboards, or home videos, 3D WorkShop gives that 3D professional-quality look.

Reach a new high in PC animation. Climb aboard. \$299.95

*Brown  
Wagh*

800-451-0900 (outside CA)  
408-378-3838 (inside CA)  
408-378-3577 (Fax)





## HARDWARE

### Compaq's Newest Notebooks

HOWARD EGLOWSTEIN

**Y**ou could always count on Compaq for two things: high quality and high prices. It seems that nothing's sacred these days. Two new Compaq notebooks, the LTE Lite/25c and Contura 3/25, may change your expectations of Compaq products.

The LTE Lite/25c is a 6.5-pound notebook with a 25-MHz 386SL processor, an active-matrix color LCD, and a tiny trackball built into the display bezel; models start at \$4999. The Contura 3/25 is one of a redesigned family of portables with many of the same internals as LTE Lite notebooks, packed into a new case and bundled with a clamp-on trackball. The 25-MHz models start at \$2099. While the competition is largely lowering prices on existing models, Compaq is introducing new, lower-cost models—without sacrificing quality or performance.

#### LTE Lite/25c

With the power off, the 25-MHz 386SL-based LTE Lite/25c looks like any other member of the LTE Lite family: a short-throw keyboard, an off-white 8½- by 11-inch case, and a full complement of ports for external connections, including an external expansion bus. A more careful examination shows a tiny trackball nestled into the lower right corner of the display bezel.

Switching the system on starts the fun. After a short delay, the 256-color active-matrix LCD kicks in with breathtaking color. The 25c's display is so good, you might not want to plug in an external monitor when you get back to your desk. The 25c is inexpensive by active-matrix color standards (similar systems from Toshiba and NEC sell closer to \$6000), but it's still much more expensive than passive-color systems. However, compared to the 25c's screen, the displays of passive-color notebooks seem dull and lifeless.

The 25c also sets an impressive precedent in battery life for active-matrix systems. A color LCD's backlighting must be much brighter than that of monochrome LCDs, and it has three times as many elements to drive per pixel. The battery life of the 25c should be shorter than that of the monochrome LTE Lite; it was, but not by much. In the BYTE Lab's battery test, the LTE Lite/25c lasted 3 hours, 4 minutes.



*The LTE Lite/25c (left) and Contura 3/25 offer very different styles and prices, but both provide solid performance and good quality.*

The new Compaq notebooks include a save-to-disk feature called *hibernation*. When the batteries begin to get low or after a fixed interval, the Compaq machines take themselves out of standby, write all the relevant memory and state information to disk, and then kill the power.

My review unit came with 4 MB of RAM and an 84-MB hard drive for \$4999 (the 120-MB model is \$5399). The 25c also comes complete with Microsoft Windows installed in several languages.

When you're running Windows, you use a thumb-driven trackball near the screen hinge on the right side of the display to position the cursor. The mouse buttons are on the outside of the case, right under your fingertips as you grip the case to move the ball. Compaq's pointing-device solution is elegant and effective, as long as you're right-handed (which I'm not). I took the machine with me on a trip to New York, and it drew a lot of interest. After they finished lusting over the screen, most folks commented that the trackball was very usable, but a bit too small and too light. I'd have the trackball closer to the keyboard; it was distracting to have to remove my hand completely from the keyboard to position the cursor.

#### Contura 3/25

The Compaq Contura doesn't share the clean, stark lines of the LTE family. It is,

## BYTE ACTION SUMMARY

#### ■ WHAT COMPAQ NOTEBOOKS ARE

The LTE Lite/25c is an active-matrix color notebook. The Contura is an inexpensive unit with a clip-on trackball.

#### ■ LIKES

The LTE Lite/25c's excellent active-matrix color LCD; the Contura's competitive price.

#### ■ DISLIKES

The 25c's trackball is for right-handers; the Contura's trackball doesn't work left-handed.

#### ■ RECOMMENDATIONS

Both units are excellent choices.

#### ■ PRICES (AS TESTED)

LTE Lite/25c, \$4999  
Contura 3/25, \$2099

#### ■ FOR MORE INFORMATION

Compaq Computer Corp.  
P.O. Box 692000  
Houston, TX 77269  
(800) 345-1518

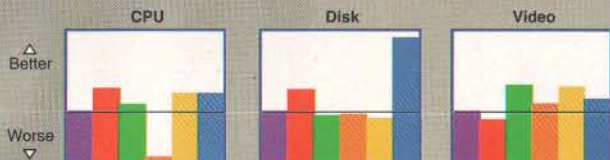
Circle 1229 on Inquiry Card.



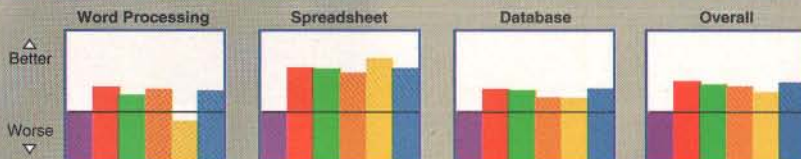
## BYTE BENCHMARK RESULTS

■ Toshiba T2200SX 
 ■ Zenith Z-Note 
 ■ Compaq LTE/Lite 
 ■ Dell NL25 
 ■ Compaq Contura 
 ■ Compaq LTE/Lite 25C

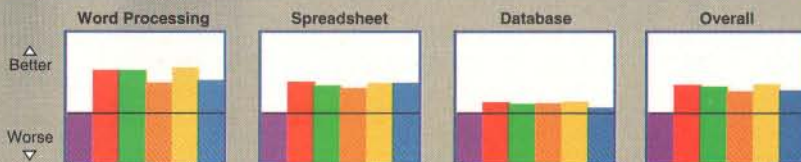
## DOS LOW-LEVEL



## DOS APPLICATIONS

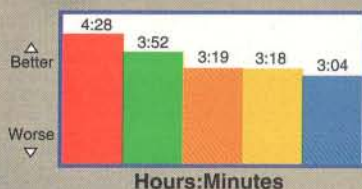


## WINDOWS APPLICATIONS



## BATTERY TEST

■ Zenith Z-Note 
 ■ Compaq LTE/Lite 
 ■ Dell NL25 
 ■ Compaq Contura 
 ■ Compaq LTE/Lite 25C



All results are indexed, and higher numbers indicate better performance. For each index in the DOS and Windows tests, a Toshiba T2200SX running DOS 5.0 and Windows 3.0 = 1.

The BYTE Lab's low-level benchmark suite identifies relative performance at the hardware level, breaking down performance by system component. The results of these tests can help you identify the relative performance of a given subsystem and determine where performance bottlenecks may lie. For a complete description of these tests, see "BYTE's New Benchmarks: New Looks, New Numbers," August 1990 BYTE. The BYTE Lab's low-level benchmarks, version 2.2, are available in the byte.bmarks conference on BIX, or you can contact BYTE directly.

The BYTE Lab's application performance suite measures the performance you can expect to see running a given application category under a given operating environment. We test under two environments: DOS 5.0 and Windows 3.0. We test three application categories for each environment, running test scripts using the following programs: Word Processing: WordPerfect 5.1 and Lotus Ami Pro 2.0; Spreadsheet: Lotus 1-2-3 release 2.3 and Microsoft Excel 3.0a; and Database: Software Publishing Superbase 4 version 1.3 and Borland dBase IV. The data files and test scripts are available from the BYTE Lab.

*The LTE Lite/25c and Contura 3/25 performed about the same, on the high end of the performance scale among 25-MHz 386SL machines. The battery-life test results of just over 3 hours are very solid and consistent with Compaq's claims.*

out as that of the LTE Lite family.

The Contura's cursor control is a Logitech Portable Trackman dressed in Contura gray. It mounts on either the right or left side of the case with a simple spring clip. If you mount it on the right, it partially blocks the floppy drive access slot. It will mount on the left, but the software refuses to remember that you've reversed button functions from Windows session to Windows session. It insists that the ball is right-handed unless you reset it each time you start up Windows. I ended up putting the Trackman back in the Contura's box and testing the machine with a Microsoft Ballpoint instead.

Compaq thoughtfully put unshifted PageUp and PageDown keys on the Contura, which makes text editing much easier. The keyboard action, layout, and excellent display proved to be an effective combination.

## Powerful Portables

Both machines are powered by 25-MHz 386SL processors, and they turned in similar performances on the BYTE benchmarks. Neither machine had the optional 387SL math coprocessor installed. The benchmark figure tells the story, but suffice it to say that you won't be disappointed by these machines running Windows or any other task.

The Contura is almost a dead match in performance for Dell's NL25 notebook. In our battery tests, the NL25 beat out the Contura's 3 hours, 18 minutes by only 1 minute. Dell recently lowered the price of its NL25 to \$1798 for a configuration similar to that of the \$2099 Contura I tested. For just \$300 more, the Contura gives you a better keyboard and a sharper display.

These Compaqs are well built and compare favorably to their competition in performance, price, and features. I also applaud Compaq's new aggressive pricing strategy; the "old" Compaq would have priced the color unit out of reach of most buyers.

One criticism: If Compaq is going to continue to bundle in Windows, I wish it would think of us left-handers when building pointing devices. The LTE Lite/25c's trackball is excellent, but it's impossible to use left-handed. The Contura's trackball software simply does not work in left-handed mode. When it comes to the new pointing devices, Compaq may have dropped the ball, but it has finally learned how to make and price notebooks. These two are definitely winners. ■

*Howard Eglowstein is a testing editor for the BYTE Lab. You can reach him on BIX as "heglowstein."*

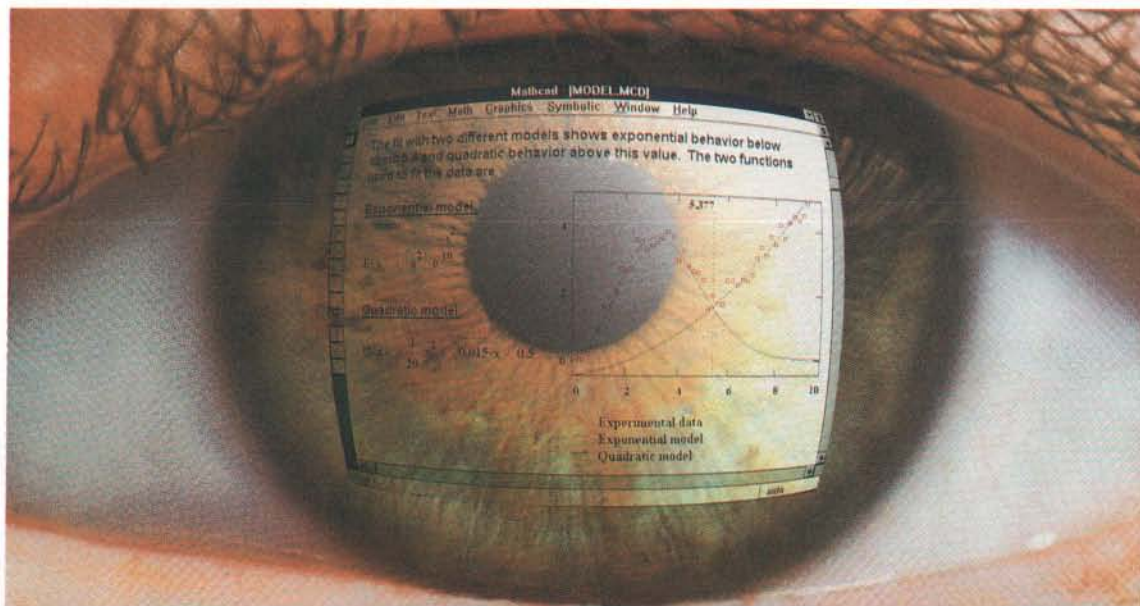
instead, styled in dark gray with mauve accents, rounded edges, and strangely contoured keys. The Contura is a bit easier to cradle under your arm than an LTE. When you pick up an LTE Lite, you spend a second or two making sure you have a firm grip on it; not so with the Contura. The hinged side has a slight indentation where

your fingers land as you grab it.

The Contura is as solid as any Compaq I've ever seen. It comes in several models, starting with the 20-MHz Contura 3/20 Model 40, with a 40-MB hard drive, for \$1699. (My \$2099 review unit ran at 25 MHz and included a 60-MB drive.) The keyboard on each model has the same lay-



# Think of it as a mathematical playground for your mind.



## Open up a whole new world of scientific and engineering problem solving with Mathcad 3.1.

Between the challenge of new problems and the reward of new solutions there is math. Often, a lot of math.

Which is why we make Mathcad.

It's the remarkable software that gives you the power to perform everything from simple arithmetic to advanced computational gymnastics more quickly, easily and naturally than with calculators, spreadsheets or programming alone.

You use Mathcad just like a scratch

pad. Simply type your work anywhere in the live screen and Mathcad does the calculating. Change variables and Mathcad automatically updates the answers. It plots in 2-D and 3-D. And prints your results, complete with text and graphics, in presentation quality documents.

Plus you see your work more clearly because Mathcad uses the same math notation you would use with a pencil and paper.

## It's the complete math system.

Mathcad comes with more than 200 commonly used functions that let you quickly build even complex equations and formulas

with exponentials, differentials, cubic splines, FFTs and more.

Full symbolic calculation capabilities are available with a menu pick. So you can evaluate any integral, Taylor series or infinite sum just by clicking.

Optional Electronic Handbooks\* give you instant access to data, formulas and diagrams once found only in reference books. They're fully interactive. Just click and paste them right into your document and work with them like any other text, value, table or formula. Or work with them right in the handbook itself.

Plus optional Applications Packs with modifiable templates are available for all major engineering and science fields.

## Over 200,000 satisfied users.

Each day, more engineers, scientists and other technical professionals discover that Mathcad opens up a whole new world of freedom in problem solving, and helps them manage their time more efficiently.

Which is why in addition to being the most popular math software you can buy, it is also the most productive.

- Microsoft® Windows,™ Motif and Open Look interfaces make Mathcad easy to learn and use
- Optional Electronic Handbooks include The CRC Materials Science and Engineering Handbook,

NOW  
**UNIX 3.1**  
AVAILABLE

Machine Design and Analysis from the *Standard Handbook of Engineering Calculations* (McGraw-Hill), and the Mathcad Treasury of Methods and Formulas

- Optional Signal Processing Function Pack contains over 60 functions including FIR and IIR filter coefficients and power spectrum

- Optional Applications Packs with adaptable templates for Electrical, Mechanical, Civil and Chemical Engineering, Statistics, Advanced Math, and Numerical Methods
- PC Windows, PC DOS, UNIX® and Macintosh® versions available

## Free demo disk.

For a free Mathcad demo disk, or upgrade information, call 1-800-628-4223, (or 617-577-1017, Fax: 617-577-8829).

Or see your software dealer.

\*Electronic Handbooks require Mathcad 3.1. © 1992 MathSoft, Inc. TM and ® signify manufacturer's trademark or registered trademark respectively.



**1-800-MATHCAD**

**The answer is Mathcad®**

**MathSoft, Inc.** 201 Broadway, Cambridge, MA 02139 USA • Phone: 1-800-628-4223 • 617-577-1017 • Fax: 617-577-8829

Australia: Hearne (03) 866 1766; Belgium: SCIA 013/55 1775; Denmark: Engberg 042-251777; Finland: Zenex 0-692-7677; France: Uniware 01-45-272061; Germany: Softline (0 78 02) 4036; Italy: Channel 02-90091773; Japan: SMI 03-5476-9816; Sweden: AkademiData (018)2400 35; Switzerland: Redacomp 032 41 01 11; UK: Adept Scientific (0462) 480055. In other locations, contact MathSoft, USA.

Circle 125 on Inquiry Card.



# Now! Northgate® Provides Novell®

How do you know the computer you get is really Novell certified? Typically, if you specify even the slightest deviation from the original certification, Novell no longer recognizes the system as certified.

Northgate knows the importance of Novell certification. That's why we have qualified to self-certify our network servers and workstations.

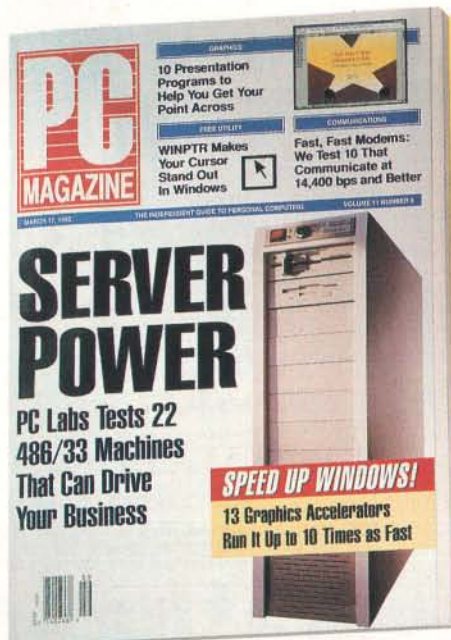
Northgate can assure you we'll ship your custom-configured, Novell-certified system in as few as four weeks, rather than the several months it takes to be certified at Novell. And, because we do all the lab work, your certified system will very likely cost less.



Self-certification capability is just one more reason why corporations coast-to-coast now rely on Northgate for all their networking needs. Northgate has your solution, too!



**Powerful File Servers and Workstations!** Select from 386 and 486 file servers, as well as a variety of workstations featuring our popular 386SX/25 systems. All are FCC Class B certified.



## Make the Editors' Choice Elegance™ 486/33e The Heart Of Your LAN!

“The Northgate Elegance 433e is a turnkey NetWare® computer with a laudable price...”



March 17, 1992  
Northgate  
Elegance 433e

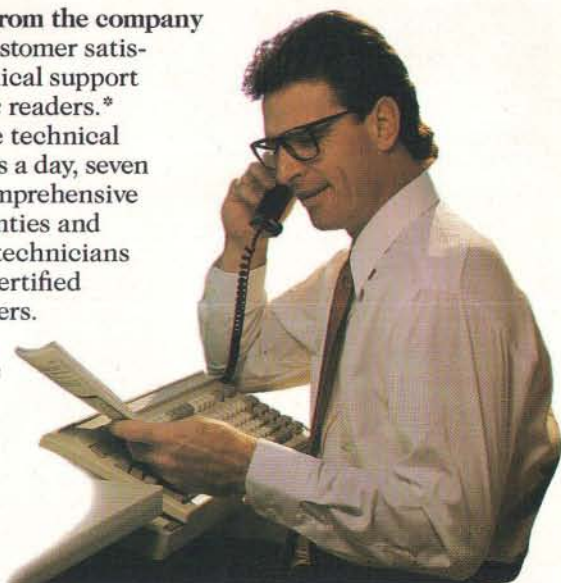
“...Northgate gives network administrators everything they need – a turnkey system with hard disks optimized for NetWare, excellent expansion capability and good performance...”

“The Northgate Elegance 433e, with its well-rounded and sensible configuration has it all; a performance/features score that's better than average and a dynamite price which together create a higher-than-average Bang for the Buck score. The server is even Novell certified.”

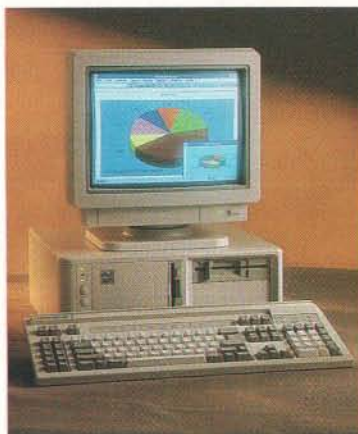


# Certification For Most Configurations!

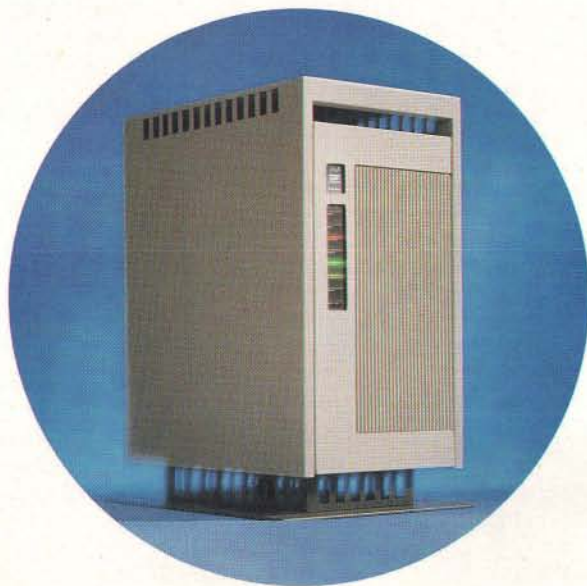
LAN solutions from the company ranked #1 in customer satisfaction for technical support by *PC Magazine* readers.\* Services include technical support 24 hours a day, seven days a week, comprehensive hardware warranties and more. Plus, our technicians are backed by Certified NetWare Engineers. This is your assurance of the best support possible.



**Choice of Topologies and Operating Software!** Select from ARCNET™, ETHERNET Thin Net, ETHERNET 10BASE-T, Token Ring or wireless LANs. Plus, NetWare® 3.11, 2.2, NetWare Lite® and LANtastic®.



**486 EISA Speed And Upgradability At Our Lowest Price Ever!** Northgate's 486 ZXP EISA workstation is upgradable across the entire range of Intel processors including: 486SX/20, SX/25 DX/33, DX2/50 – even the new DX2/66! Features up to 128 MB RAM, 32-bit EISA controller, EISA bus and more. Call for specs and pricing!



Get up to 4GB of fault-tolerant disk storage with the OmniArray parallel disk array. Northgate RAID technology uses four drives plus a fifth parity drive giving you true high disk fault tolerance and high data availability. Novell certified.

**Call for complete custom configuration information.  
800-345-8709**

Major corporations, volume purchasers and government agencies call National Business Accounts: 800-545-6059  
GSA# GS00K91AGS5193 PS01

Charge it to your VISA, MasterCard, Discover, American Express and Northgate Big 'N' Card. 12-60 month leasing plans also available.



**"When it has to work right"™**

7075 Flying Cloud Drive, Eden Prairie, MN 55343

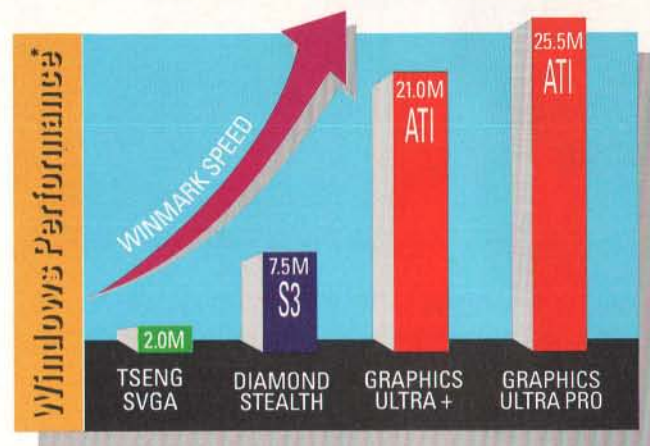


# Stop Compromising on Graphics!

Get Speed, Color, and Resolution ALL at the Same Time

Tired of sacrificing color and speed for high resolution? Now there's a *No Compromise Graphics* solution: ATI's new generation of graphics accelerators. A new standard that delivers fast 1024 x 768 graphics at 65,000 vibrant colors.

***Anything less is a compromise.***



Resolution and Color Support	ATI	S3	SVGA
1024 x 768 / 65,000	■	■	■
1024 x 768 / 256	■	■	■

## GRAPHICS ULTRA PRO

- ▶ Fast 25.5 million WINMARK performance
- ▶ Accelerated 1280 x 1024 at 256 colors non-interlaced at 74 Hz refresh rate
- ▶ Available in ISA, EISA or MicroChannel versions
- ▶ Priced from \$599.00\*\*



## GRAPHICS ULTRA +

- ▶ Fast 21.0 million WINMARK performance
- ▶ Accelerated 1024 x 768 at 65,000 colors
- ▶ True color (16.7 million) at 800 x 600
- ▶ Available in 2.0 MB or 1.0 MB versions
- ▶ Priced from \$399.00\*\*



**ATI TECHNOLOGIES INC.**  
3761 Victoria Park Avenue  
Scarborough, Ontario  
Canada M1W 3S2  
Tel: (416) 756-0718  
Fax: (416) 756-0720

*Perfecting the PC*

Copyright © ATI Technologies Inc., 1992. All company and/or product names are trademarks and/or registered trademarks of their respective manufacturers. \*\*Suggested Retail Price. Prices subject to change without notice. \*Winbench 2.5 on 486-33 at 1024 x 768 / 256 colors at 60 Hz. Awards based on award winning technology of GRAPHICS ULTRA and VGA WUNDER.

Circle 74 on Inquiry Card.



## HARDWARE

# Color Ink-Jet Printers Take Whacks at Wax

HOWARD EGLOWSTEIN

**Y**ou're looking for a color printer. Quality printing and good solid colors require a laser printer, right? The only technology available for a reasonable price is wax transfer, right? Not necessarily. The Canon CJ10 and Hewlett-Packard PaintJet XL300 color ink-jet printers are ready and willing to make your desk a brighter place to work.

### Canon CJ10

If the CJ10 were simply a 400-dot-per-inch color ink-jet printer, that would be reason enough to take a look at it. The CJ10 incorporates both a four-color printer using Canon's color Bubble-Jet technology and a letter-size color 24-bit scanner into a single, compact desktop unit. The base price of \$6995 gives you a color copier; add another \$2700 for the optional IPU (image processing unit) and you get a complete graphics workstation. The IPU connects to your DOS/Windows machine or your Mac and provides both color output and scanner services for most applications.

The scanner portion of the CJ10 is an interesting variation on the conventional flatbed scanner. A single optical head picks up 256 bits each of red, green, and blue as it makes horizontal swipes across the width of the page. After each swipe, it moves down the page and repeats the process. Although it picks up all three colors in a single swipe, it's not really a single-pass scanner in the conventional sense. Scanning a full page takes about a minute and a half—about average for color scanners these days. The CJ10's printer uses Canon's BC-40 400-dpi print head and specially coated paper. The paper has a surface that enhances the brilliance of the ink—short grain to prevent wicking (or smearing) and a coated back to keep the ink from soaking through the paper. It's quiet, too; I tested the CJ10 on a large 486 system, and the printer made less noise than the computer's cooling fan.

You connect the CJ10 and IPU to your PC or Mac with one of two installation kits. The PC kit comes with an Adaptec SCSI board, Windows drivers, and a special edition of Aldus's PhotoStyler. The drivers allow any Windows application to access the CJ10 as a native Windows printer. It's not PostScript, so to get beautiful-



*Two new offerings from the biggest names in ink-jet technology. The HP PaintJet XL300 (left) is the latest in the PaintJet family and replaces several other PaintJet models for Mac, PC, and Unix platforms. The Canon CJ10 (right) combines a color copier, a 400-dpi color printer, and a color scanner into a single desktop unit.*

## BYTE ACTION SUMMARY

### ■ WHAT THESE PRINTERS ARE

The Hewlett-Packard PaintJet XL300 is a 300-dpi color ink-jet printer. The Canon CJ10 combines a color copier, a 400-dpi color printer, and a color scanner into a single desktop unit.

### ■ LIKES

Both printers produce crisp, bright color output. The CJ10 multifunction solution is incredibly convenient.

### ■ DISLIKES

Neither is suitable as a color proofing device.

### ■ RECOMMENDATIONS

The XL300 is a good choice for network applications to complement existing laser printers. The CJ10 is a superb bit-map printer.

### ■ PRICE

Canon CJ10 copier, \$6995; IPU interface with 2 MB of RAM, \$2700; IPU interface with 16 MB of RAM, \$5500  
HP PaintJet XL300: with 2 MB of RAM, \$3495; with PostScript Level 2 and 6 MB of RAM, \$4995; 4-MB memory upgrade, \$599

### ■ FOR MORE INFORMATION

Canon U.S.A., Inc.  
One Canon Plaza  
Lake Success, NY 11042  
(516) 488-6700  
fax: (516) 488-3623  
**Circle 1223 on Inquiry Card.**

Hewlett-Packard Co.  
Direct Marketing Organization  
P.O. Box 58059  
MS511L-SJ  
Santa Clara, CA 95051  
(800) 752-0900  
fax: (208) 344-4809  
**Circle 1224 on Inquiry Card.**

ly formed characters on the page, you will want Adobe Type Manager or something similar. The Mac drivers install as a QuickDraw printer; you'll need ATM on the Mac as well for text output. A CJ10 networking utility lets you share the CJ10 with other AppleTalk users.

### HP PaintJet XL300

Imagine a 300-dpi LaserJet that prints in full 24-bit color, uses ink-jet cartridges, prints 11- by 17-inch pages (with an optional paper cartridge), and takes up a lot of desk space. The HP PaintJet XL300 is the latest in the PaintJet family and





*The Canon CJ10 output (left) is sharp and clear; the special Canon paper makes the colors virtually leap off the page. The HP XL300 output (right) doesn't have the banding problem of the CJ10, but its colors tend to be a bit murky compared to those of the Canon output.*

replaces several other PaintJet models for Mac, PC, and Unix platforms.

The PaintJet thinks it's a LaserJet in many ways. It handles the color version of HP's PCL 5 printer control language, it uses the same memory and network interface cards as the HP LaserJet III, it offers built-in PostScript Level 2, and it can use the same drivers as the LaserJet for monochrome applications.

The innards are very similar to the older PaintJet models. A scanning head with four colored print heads scans back and forth over the page. On both sides of the paper, heating elements dry the ink before the page leaves the printer. The XL300 will take standard copier paper, specially coated PaintJet paper, transparencies, or "glossy paper," which is a lot like plastic transparency sheets, only opaque.

PCL 5 automatically includes a variety of scalable outline fonts and HP plotter emulation using HPGL/2. The included drivers support Windows, Macintosh, and selected DOS applications. If your application isn't supported, the XL300 will take output from any application that can talk to a LaserJet III or PaintJet printer or an HPGL/2 plotter.

### Color, Color Everywhere

HP is positioning its printer as a natural addition to offices that already use laser printers. Canon is targeting businesses that

could not previously afford color output. I immediately positioned both on my desk, connected them to my 486 machine, and tried them out with a variety of software packages. On both printers, I ran some samples from CorelDraw 3.0 to see how the printers handled graphics and spreadsheet-type applications. The CJ10 couldn't reproduce some of the subtle shading the XL300 could, and the XL300 did a better job of matching the screen colors.

I used Canon's Windows drivers to link the CJ10's scanner to PhotoStyler and made several test scans. The images were very consistent, although a bit contrasty and heavy in the red-orange area. I expected the horizontal scanning technique to show some banding in the scan, but it didn't. As you might expect, printing something scanned on the CJ10 worked well. The printer tends to print with the opposite color skew of the scanner, resulting in near-perfect output. The special Canon paper makes the colors virtually leap off the page. The printer prints in bands, and the bands overlap slightly, leaving subtle lines across the page.

To test the XL300, I scanned the same images with an Epson ES-300C and printed them using PhotoStyler. The XL300 doesn't have the banding problem of the CJ10, and its colors tend to be a bit dark and murky compared to the CJ10 (see the print samples). Its output looks fine—no,

better than that—but not quite as stunning as the CJ10 output. The only problem was memory. Printing a full 8½- by 11-inch image requires a 4-MB upgrade to the base 2-MB model. I had only enough to print an area about 3½ by 5 inches. To print a full 11- by 17-inch page requires an 8-MB upgrade.

You wouldn't have to ask me twice to put either printer on my desk. The XL300 is an easy fit for network applications to complement existing laser printers or to replace pen plotters in some applications. I wouldn't want one as a color proofing device for color bit-map work, though.

The XL300 does the best job of printing area graphics of any printer the BYTE Lab has tested. I'd opt for extra memory and the PostScript option, though. The CJ10 is a superb bit-map printer, and having the scanner integrated into a single unit is incredibly convenient. While the color isn't perfect, it's less dithery than with wax-transfer printers, and the overall effect is more breathtaking than anything I've seen from other printers in the same price range.

Either way, you can have my LaserJet Series II. After working with these two printers for a few weeks, I find black-and-white output to be quite boring. ■

*Howard Eglowstein is a testing editor for the BYTE Lab. You can reach him on BIX as "heglowstein."*



## HARDWARE

# DGX Takes the Direct Approach to Graphics Performance

JAKE RICHTER

**B**ack at last fall's Comdex, Dell gave everyone a taste of what local-bus technology could accomplish. The project was code-named JAWS, and it made an impressive demonstration. This summer, JAWS grew into a real product—the Dell PowerLine 450DE/2 DGX (for Direct-Coupled Graphics Xccelerator).

The PowerLine DGX is similar to the PowerLine 450DE/2 that BYTE reviewed in July ("Dueling DX/2s: The First 486 Clock Doublers"); both are desktop systems based on Intel's 50-MHz 486DX2. The PowerLine DGX sells for \$4399 and comes in a configuration similar to that of the standard PowerLines: 8 MB of RAM, a 120-MB hard drive, and a 16-inch monitor. Like other PowerLine systems, the PowerLine DGX also includes a Tseng ET-4000-based Super VGA on the motherboard. But the DGX version includes a completely redesigned CPU card that speeds graphics processing by adding a second complete graphics system wired directly to the CPU bus.

### Heart of DGX

The DGX controller card includes both the system's 486DX2 CPU and the local-bus graphics controller. By integrating these onto the same board, Dell was able to directly connect the display frame buffer to the CPU, thereby achieving data transfer rates close to those of regular system memory. This is the basic design of a local-bus system.

The DGX graphics system, with its 2 MB of video RAM, sports two modes: a pass-through mode, in which the display data generated by the built-in VGA is displayed on the monitor connected to the DGX controller; and a native mode, in which software that knows how to directly control the DGX graphics device can take over the display for improved performance.

The DGX controller supports an impressive range of resolutions and color depths in native mode, including 1024- by 768-pixel and 1152- by 900-pixel displays with 16-bit color, and 1280 by 1024 pixels with 256 colors. DGX also supports high vertical-refresh frequency modes (70 Hz at



*The PowerLine 450DE/2 DGX delivers fast, high-resolution, 16-bit graphics, but it requires driver support for each application or environment.*

## BYTE ACTION SUMMARY

### ■ WHAT THE DELL POWERLINE 450DE/2 DGX IS

A 486DX2/50 with a proprietary local-bus scheme for fast graphics.

### ■ LIKES

Windows and AutoCAD graphics performance is outstanding; there is a wide variety of drivers for many environments.

### ■ DISLIKES

DGX-specific drivers are required for local-bus operation.

### ■ RECOMMENDATIONS

DGX is a good choice for supported environments.

### ■ PRICE

\$4399

### ■ FOR MORE INFORMATION

Dell Computer Corp.  
9505 Arboretum Blvd.  
Austin, TX 78759  
(800) 426-5150  
(512) 338-4400  
fax: (512) 338-8421

Circle 1225 on Inquiry Card.

1024 by 768 pixels and 72 Hz at lower resolutions).

While DGX is touted as a graphics accelerator, it's really just a better frame-buffer controller. DGX doesn't have the special hardware commonly associated

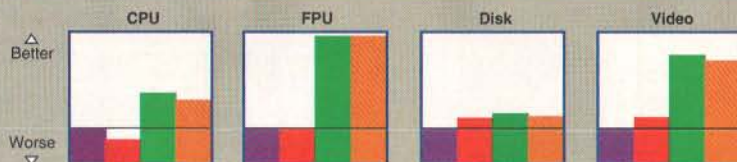
with graphics accelerators; it just delivers greater data transfer bandwidth. However, DGX includes a hardware cursor. This is extremely useful in windowing environments, since software doesn't have to continually disable and enable the cursor while



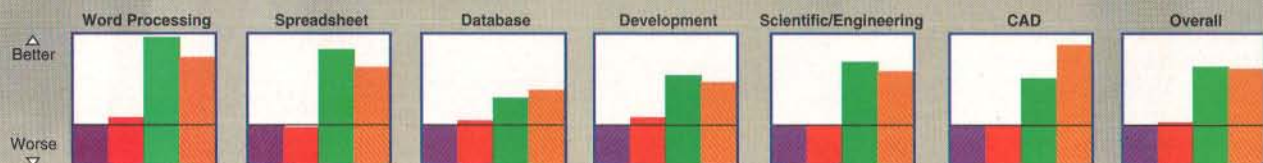
## BYTE BENCHMARK RESULTS

■ Compaq Deskpro 386/33L
 ■ NEC PowerMate 386/33i
 ■ Compaq Deskpro 486/50L
 ■ Dell PowerLine 450DE/2 DGX
 ■ Sun Sparcstation IPC

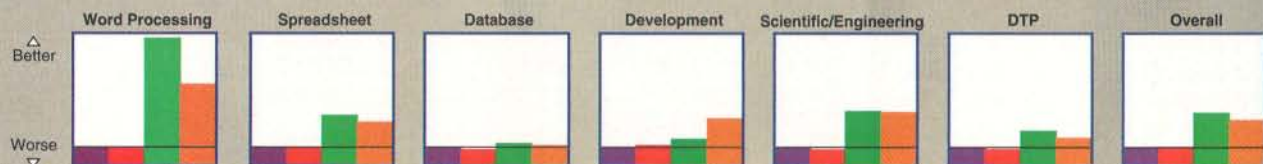
### DOS LOW-LEVEL



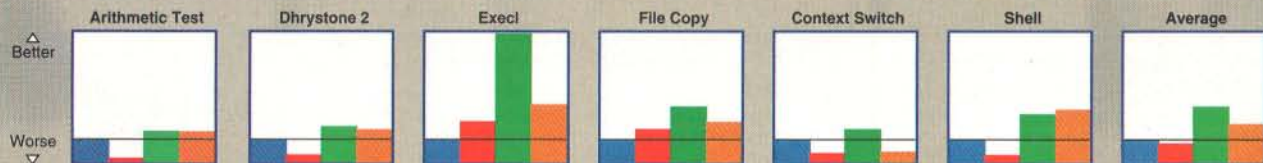
### DOS APPLICATIONS



### WINDOWS APPLICATIONS



### UNIX



All results are indexed, and higher numbers indicate better performance. For each index in the DOS and Windows tests, a Compaq Deskpro 386/33L running Compaq DOS 5.0 and Windows 3.0 = 1. For each index in the Unix tests, a Sun Sparcstation IPC = 1. The overall index is the average index of the individual tests.

The BYTE Lab's low-level benchmark suite identifies relative performance at the hardware level, breaking down performance by system component. The results of these tests can help you identify the relative performance of a given subsystem and determine where performance bottlenecks may lie. For a complete description of these tests, see "BYTE's New Benchmarks: New Looks, New Numbers," August 1990 BYTE. The BYTE Lab's low-level benchmarks, version 2.2, are available in the byte.bmarks conference on BIX, or you can contact BYTE directly.

The BYTE Lab's application performance suite measures the performance you can expect to see running a given application category under a given operating environment. We test un-

der two environments: DOS 5.0 and Windows 3.0. We test six application categories for each environment, running test scripts using the following programs: Word Processing: WordPerfect 5.1 and Lotus Ami Pro 2.0; Spreadsheet: Lotus 1-2-3 release 3.1+ and Microsoft Excel 3.0a; Database: Software Publishing Superbase 4 version 1.3 and Borland dBase IV; Development: Borland Turbo Pascal for Windows and Microsoft C 6.0; Scientific/Engineering: MathSoft Mathcad for Windows 3.0, The MathWorks MatLab 3.5k, and Computing Resource Center Biturbo Stata 2.1; CAD: Autodesk AutoCAD release 11; and Desktop Publishing: Aldus PageMaker 4.0. The data files and test scripts are available from BYTE.

Our Unix tests show relative performance for double-precision arithmetic, the Dhrystone 2 benchmark, spawning a process (execl()), file copy throughput, pipe-based context switching, and running a shell script with eight concurrent scripts running. Unix benchmarks are available on Usenet, from Demolink, in the listings area on BIX, or on disk.

*The benchmarks show best performance under Windows and AutoCAD, two environments supported by DGX drivers; other benchmarks are run on the PowerLine's standard VGA hardware. Note that the Windows benchmarks are run in 256-color mode on the PowerLine and 16-color mode on the baseline Deskpro 386/33L and other comparison systems.*

drawing near it. A hardware cursor is also more pleasing aesthetically, since it doesn't flicker.

From a programming perspective, the DGX graphics subsystem is designed primarily for protected-mode access. While

it's technically possible to access the DGX frame buffer from a real-mode program, it's probably more of a hassle than it's worth. The DGX frame buffer can be mapped into one of three locations in the PC's address space as one contiguous 4-

MB block. This simplifies graphics programming, since there is no tedious bank switching involved—a process that dominates all real-mode Super VGA graphics programming and applications. This DMA, combined with well-written driver



# NEW!

Northgate® SlimLine™ Is Back And Faster Than Ever!

**DX2/66**  
Available  
Now!

# Northgate Local Bus High Speed Windows And GUI Video – An Industry First!



## Northgate ZXP System With Unlimited Upgradability - Compatible With Intel® SX/25, DX33, DX2/50, DX2/66 And All OverDrives!

**A Northgate Exclusive! No other computer offers this price/performance!**

- Intel 80486SX™/25 MHz processor
- 4MB of RAM; expands to 32MB on board
- Virtual Cache – Zero Wait State Performance
- 100MB hard drive
- 1.2MB or 1.44MB floppy drive
- High-speed local bus VGA with 1MB video RAM
- 1024 x 768 monitor
- MS-DOS® 5.0, Microsoft® Windows™ 3.1 and mouse
- Award-winning Northgate service and support
- 30-day no-risk money back guarantee
- Winmarks (V2.5) of 7.9 million;
- PowerMeter™ MIPS (V1.7) of 14.8



Call for more information!  
**800-345-8709**



Major corporations, volume purchasers and government agencies call National Business Accounts: 800-545-6059

GSA# GS00K91AGS5193 PS01

Major credit cards, money orders, direct wire and approved company purchase orders accepted.



7075 Flying Cloud Drive, Eden Prairie, MN 55344

**"When it has to work right"™**

©Copyright Northgate Computer Systems, Inc. 1992 All rights reserved. Northgate, SlimLine, ZXP and the Northgate logo are U.S. trademarks or registered U.S. trademarks of Northgate Computer Systems. 80486SX and 80486 are U.S. trademarks of Intel. MS-DOS, Windows and Microsoft are U.S. trademarks or registered U.S. trademarks of Microsoft Corporation. All other products and brand names are U.S. trademarks or registered U.S. trademarks of their respective companies. Prices and specifications subject to change without notice. Prices shown do not include shipping/handling charges and appropriate sales taxes. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability. We support the ethical use of software. To report software copyright violations, call the Software Publishers Association's Anti-Piracy Hotline at 1-800-388-PIR8. All systems shipped with DragSoft™ QA Plus™ software. \*\*Monthly lease payments are based on a 36-month standard fair-market value open-ended lease. 12-60 month leasing options available for qualified businesses.

CODE B4609



software, can give DGX native-mode graphics a really substantial performance boost.

## **Some Drawbacks**

There are two drawbacks to DGX's architecture. First and foremost, you won't see any acceleration with DGX unless you're using an environment or application supported by a DGX driver; this is a restriction not imposed on most local-bus designs. Without a DGX driver, the system will

run from the Super VGA on the motherboard at normal VGA speeds. The PowerLine DGX ships with drivers for Windows, AutoCAD, X Window System, AutoShade, 3D Studio, Animator Pro, CAD-Key, and Intergraph MicroStation. Dell also plans drivers for NextStep, Windows NT, Open Desktop, and Solaris.

The other drawback (of limited concern to most users, but of real concern to developers) is that the technical documentation for DGX is difficult to obtain; and

when you finally get it, you'll find it disappointingly sparse.

## **How Much Faster?**

The BYTE Lab's standard benchmark suite (see the figure) gives a good measure of overall performance, but the Windows application results may be misleading. The Lab tested the baseline system, which provides the basis for the performance indexes, with Windows in 640- by 480-pixel by 16-color mode. At a minimum, Dell's DGX drivers support 256 colors at that resolution. Thus, the benchmark results compare the DGX system with 8-bit color against the baseline and comparison machines with 4-bit color. That the DGX system compares closely, at twice the color depth, with a full 50-MHz Deskpro indicates its speed under Windows.

I wanted to determine more precisely the speed of graphics operations with and without DGX. I compared the memory-to-screen performance of the DGX under Windows to that of an optimized Windows driver running on the built-in Super VGA at the same resolution. The DGX achieved a data transfer rate of 15.4 million pixels per second, compared to 4.5 million pixels per second for the Super VGA. Overall, DGX performed about three times as fast as the built-in Super VGA.

In a few areas, though, the Windows performance of the built-in Super VGA exceeded that of the DGX. This can probably be attributed to the (still beta, at this writing) DGX Windows driver not being quite as optimized as it could be.

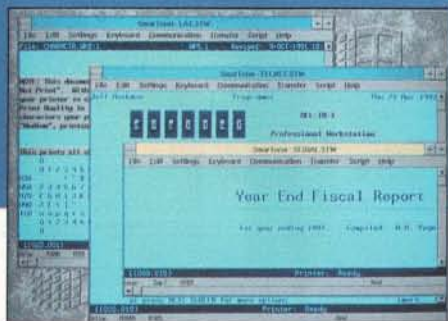
Benchmarks aside, the Dell DGX system simply flies when running AutoCAD and Windows. The performance difference between non-DGX and DGX operation is extremely noticeable, which is great if you use graphics applications supported by DGX drivers.

If all you use are text applications, or graphics applications not supported by DGX-specific drivers, then getting a DGX-based system would be wasteful. Also, to upgrade the DGX to a faster graphics solution, should one come along, you'll need to swap entire processor cards.

On the other hand, if you are simply interested in speed and you're looking for an extremely fast Windows or AutoCAD system right now, take a serious look at the PowerLine 450DE/2 DGX. ■

*Jake Richter is the chief technologist at Panacea, Inc., a graphics driver development and publishing company. You can reach him on BIX as "jrichter," on CompuServe at 75130,2705, on MCI Mail at 351-5206, and on America On-Line as PanacJake.*

# **Complete, Powerful Connectivity** **SmarTerm<sup>®</sup> 420 for Windows** **version 2.0**



Access multiple host computers, including VAX/VMS and UNIX/Unix host systems, simultaneously. SmarTerm 420 for Windows includes LAT, Telnet, and FTP at no extra charge.

New SmarTerm 420 for Windows version 2.0 clearly puts more VT emulation power and ease at your fingertips. New features include scrollback, color selection, font resizing, and ANSI color support. Toolbox, button palettes, trace and remapping utilities, and customizable-help reduce support needs. SmarTerm 420 for Windows still offers error-free file transfer, scripting, and keyboard mapping. Plus, you get LAT, Telnet, and FTP at no extra cost. SmarTerm, connecting users worldwide, is also available for VT320 and VT340 emulation using DOS.

Persoft, Inc. 465 Science Dr. P.O. Box 44953  
 Madison, WI 53744-4953 Call toll-free 1-800-EMULATE  
 Fax (608) 273-8227  
 European Headquarters World Trade Ctr. Beursplein 37  
 Box 30237 3001 DE Rotterdam The Netherlands  
 Phone +31 10 405.3560 Fax +31 10 405.5073

**persoft**  
 CONNECTIVITY SOLUTIONS  
 DOS • Windows • Ethernet • Token Ring



# While Our Competitors Are Diligently Trying To Emulate The SummaSketch® II...

## We Proudly Announce SummaSketch II *Plus*

The world's best selling, most emulated, most acclaimed desktop tablet just got better. We've taken SummaSketch II, the industry standard, and added several new features to create a tablet that is, unquestionably, the world's best.

Unlike some competitors, we put everything in the box—4-button cursor and 2-button stylus (or 16-button cursor), interface cables and a utilities diskette with Windows® 3.0 and ADI® drivers. Plus we've added things like 2000 lines per inch resolution and 10 mil accuracy—standard. Plus the fastest, easiest set-up and configuration procedure. Plus an offer for a free AutoCAD® or CADKEY® Master Template (a \$245 value). Plus software compatibility



with over 400 programs, and hardware compatibility with PCs and Macintosh®. Best of all, it's still 100% pure SummaSketch—the editor's choice, winner of every major editorial accolade for graphics tablets. And the people's choice, with well over one-half million sold to demanding computer graphics professionals.

**Every decision**

**should be this easy.** In fact, the only tough decision is which Plus to choose: 12" x 12" or 18" x 12" Professional. For literature, or the name of your local dealer, call 1-800-729-7866. For technical information call 203-881-5400.



### Summagraphics®

Every decision should be this easy.™

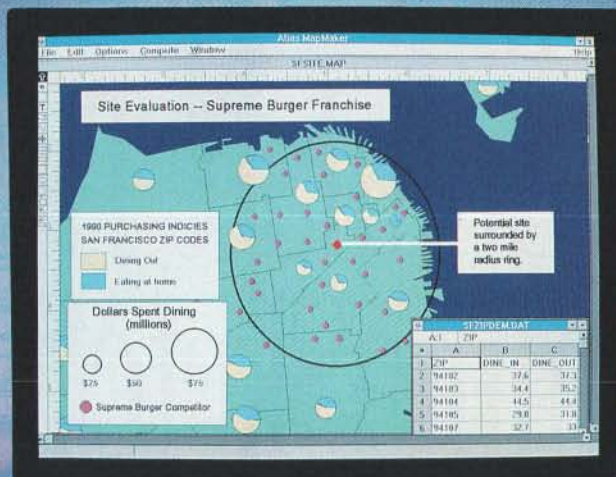
© 1992 Summagraphics Corporation. Seymour, CT 06483. All rights reserved.

Circle 175 on Inquiry Card.



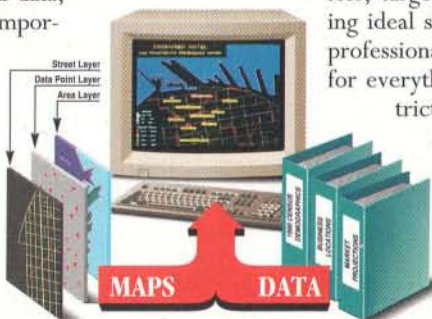
# ATLAS SOFTWARE

## A NEW DIMENSION IN DATA MANAGEMENT



**M**

ost business and government professionals view and analyze data with spreadsheets, databases and occasionally in business graphics packages. While these types of software work well when displaying statistical data, they are blind to important geographical information — such as market potential by sales territory, distribution coverage by product, or customer locations by ZIP code or street address.



*Atlas Software™* is changing that. By linking data from spreadsheets, databases and even other applications — on your PC or Macintosh® — you can now add the important geographical dimension to your information system.

And when we say important, we mean mission critical. For example, *Atlas Software* can help business professionals answer "what if" and "show me where" questions for optimizing sales territories, targeting customers, and selecting ideal site locations. Government professionals can use *Atlas Software* for everything from political redistricting to land-use planning and public safety analysis. Without *Atlas Software* decision makers often overlook important geographic information and allocate resources ineffectively.

*Atlas Software* programs come equipped with built-in data management capabilities, map file importing and a generous

base map and data sampler from our comprehensive library containing over 75 gigabytes of geographic files, business statistics and demographic data.



*Atlas Software* comes in a variety of "flavors" to suit your specific needs and supports MS DOS®, MS Windows® and Macintosh operating systems.

So if you're ready to add a dynamic new dimension to the way you use information, like 25,000 other Strategic Mapping customers, call us for a free *Desktop Mapping Guidebook* and demo disk. We'd be happy to map out a plan for you.

**Phone: (408) 970-9600**  
**FAX: (408) 970-9999**



In Canada, call 416-693-4166  
In the UK, call 44-81-994-2780  
In Germany, call 49-228-62-73-82  
In Australia, call 61-3-866-1766  
In Belgium/LUX, call 32-2-771-25-75

In the Netherlands, call 34-340-266-336  
In France, call 33-1-45-27-20-61  
In Denmark, call 45-42-25-17-77  
In Spain, call 34-1-564-1356  
In Brazil, call 5521-262-9459

Circle 173 on Inquiry Card.



## SYSTEM AND HARDWARE

### Racing at 33 MHz: Quadra 950 and Radius Rocket 33

TOM THOMPSON

The Mac community hardly had a chance to catch its breath after Apple redefined high-performance late last year with its Quadra line. This summer, Apple unveiled its Quadra 950. Like the Quadra 900, the new machine is a tower design, but the 950's 68040 processor runs at 33 MHz, and the new system comes standard with 8 MB of RAM. The result is a claimed 30 percent boost in CPU processing power over the 900.

But there's more than one way to put together a 33-MHz 68040-based Mac. The Radius Rocket 33 is a 33-MHz, 68040-based accelerator board that brings this new level of performance to the Mac II, IIfx, IIfx, and IIfx.

#### A New Hot Rod

The Quadra 950 is essentially a Quadra 900 chassis with a new main logic board. This design strategy let Apple turn out the Quadra 950 in a short time, and it also provides an upgrade path for Quadra 900 owners. Until the end of the year, Quadra 900 owners can upgrade to a Quadra 950 for \$1499 and a board swap.

There are significant additions to the new logic board besides the faster CPU. First, Apple boosted the I/O bus clock speed from 15.67 MHz to 24.28 MHz. This reduces I/O latency to all I/O devices (e.g., serial, video, and SCSI) connected to the bus. Also, the 950's faster 25-MHz Ethernet controller chip provides faster network throughput.

The Quadra 950's built-in video circuitry uses a different DAC (D/A converter) and video controller ASIC (application-specific IC) than the Quadra 900's. These changes supply two new features: First, the built-in video now supports a 16-bit pixel depth, which displays 32,768 colors (32-Bit QuickDraw uses 1 bit as an alpha channel, so only 15 bits in the pixel contain actual color information).

Second, the 950 handles a new display size of 1024 by 768 pixels. The 950 includes modified ROM code to support the



*Two alternatives for Mac computing at the highest level: Apple's new Quadra 950 sets the standard, while Radius's Rocket 33 accelerator board can give Quadra-class performance to older Macs.*

new pixel depth and display size. With 2 MB of VRAM (video RAM), the Quadra 950 can provide 16-bit-deep screens on all monitors up to 21 inches (1152 by 870 pixels) in size. Because of the faster processor bus, VRAM SIMMs rated with an 80-nanosecond access time are required; you can't get away with using 100-ns VRAM like you could on the Quadra 700 and 900.

#### The Rocket 33 Remedy

If you own an older modular Mac, Radius has a plug-in accelerator board that supplies roughly the same processing power as a Quadra 950 without requiring that you junk your hardware investment.

The Radius Rocket 33 (\$2499) is a 33-MHz, 68040-based accelerator board that manages up to 128 MB of RAM. The Rocket 33's design is elegant: a NuBus

board and some software, with no scary hacking of logic board traces or yanking of chips required for installation. Just transfer the SIMM RAM (80-ns or better required) from the main logic board to the Rocket's eight SIMM sockets, and plug the board into an unoccupied NuBus slot. Note that you must leave 2 MB of RAM on the main logic board so that the computer can boot, although that RAM isn't used in subsequent operations.

When the Mac first boots, Radius's software performs some intricate initialization maneuvers and restarts the system. The second time the Mac starts, the Rocket board assumes control, and the Mac's main logic board operates as a smart I/O processor for the Rocket.

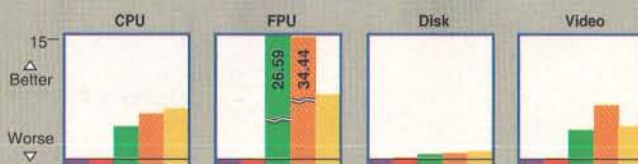
The RadiusWare Control Panel software automatically recognizes applications (e.g., Microsoft Word 4.0) that are



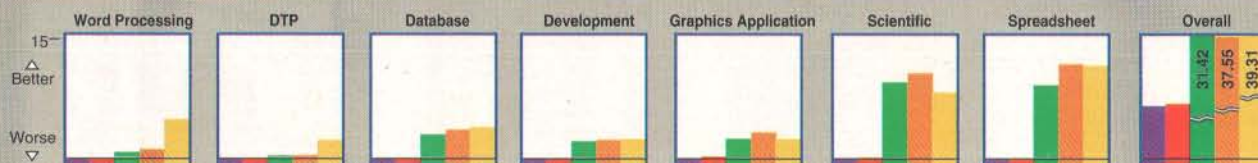
## MACINTOSH BENCHMARK INDEXES

Mac Classic II    Mac LC II    Quadra 900    Quadra 950    Radius Rocket 33

## LOW-LEVEL PERFORMANCE



## APPLICATION-LEVEL PERFORMANCE



The Quadra 950 is 28 percent faster than the Quadra 900. The Rocket 33 provides nearly equivalent performance. The Quadra 950's processor caches were disabled during the word processing and desktop publishing tests, which degrades performance and gives the Quadra 950 a deceptively low overall index. Note that the Rocket 33 doesn't fare as well on the floating-point tests.

All machines were tested using System 7.0.1. Except for the Dhrystone test, all results are indexed. For each test, a Mac Classic II = 1, and higher numbers indicate faster performance. The floating-point benchmarks use the SANE library. Comprehensive test results and detailed configurations are available for all machines on request.

## Dhrystones

Mac Quadra 950	25,000
Radius Rocket	25,000
Mac Quadra 900	16,666
Mac LC II	2000
Mac Classic II	2000

## BYTE ACTION SUMMARY

## ■ WHAT THE QUADRA 950 AND ROCKET 33 ARE

The Quadra 950 is Apple's 33-MHz 68040-based computer. The Rocket 33 is a 33-MHz 68040-based NuBus accelerator board.

## ■ LIKES

The Quadra 950 offers more processing power than its predecessors and supports a new display size and pixel depth. The Rocket 33 revitalizes older Macs.

## ■ DISLIKES

The Rocket 33 has some compatibility problems with Mac sound, QuickTime, and virtual memory. It also doesn't work in a Mac IIsi or IIfx.

## ■ RECOMMENDATIONS

If you don't own a Mac or you need the ultimate in processing

power, get the Quadra 950. If you already own a NuBus Mac, consider the Rocket 33.

## ■ PRICE

Quadra 950 (includes a 13-inch RGB monitor, a 230-MB hard drive, and a standard keyboard), \$9517  
Radius Rocket 33 (no RAM), \$2499

## ■ FOR MORE INFORMATION

Apple Computer, Inc.  
20525 Mariani Ave.  
Cupertino, CA 95014  
(408) 996-1010  
**Circle 1226 on Inquiry Card.**

Radius, Inc.  
1710 Fortune Dr.  
San Jose, CA 95131  
(408) 434-1010  
fax: (408) 434-0770  
**Circle 1227 on Inquiry Card.**

incompatible with the 68040's copyback cache mode and compensates by setting the 68040 cache to write-through mode. If you have a Radius monitor, there's a QuickColor Control Panel that provides QuickDraw acceleration so that video runs a tad faster.

I put the Rocket 33 in a Mac II with 8 MB of RAM, a 100-MB hard drive, a Radius DirectColor/24 display board, and a 19-inch Radius monitor. The Rocket ran System 7.0.1, with a few limitations: Radius's software (version 1.3) garbles sound playback and breaks both virtual memory and QuickTime. Photoshop 2.0.1 worked fine, even when capturing images from a color scanner (an Epson 300C) connected through the SCSI port.

Unfortunately, the Rocket 33 has some failings. In addition to the software incompatibilities (which Radius should fix in later releases), it limits your choice of Mac hosts. The Rocket 33 is incompatible with the Mac IIfx, and, with 8 MB of RAM, the board draws a hefty 16 watts, which puts it outside the Mac IIsi's power budget.

## Comparing Performance

The BYTE Lab's low-level benchmark results show that the Quadra 950 is the most powerful Mac to date, with noticeable



# Up to Date. Down to Earth.



UNIX is changing the world of computers, the world of business – quite simply, changing the world. It's revolutionizing office automation. It's required for U.S. government computer contracts. It's the backbone of information strategies worldwide.

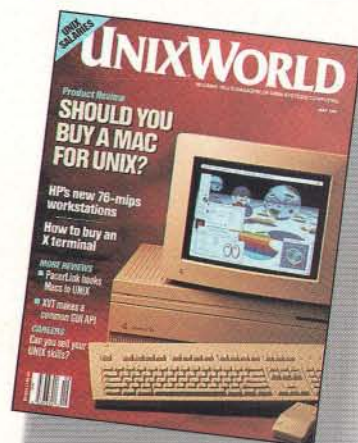
That's why you need **UNIXWORLD** – the magazine that keeps you up to date on the rapidly changing world of open systems computing. Each issue brings you the latest product trends and technical advances that can affect your business. The inside story on some of the biggest high-tech companies. Easy-to-understand programming tips and tutorials that can help your company use UNIX to its fullest. And unbiased hardware

and software reviews to help you invest wisely when you buy.

**UNIXWORLD's** in-depth features go beyond dry technical facts to show how the pieces fit together – to tell you what's important about the advances and strategies that are changing your world. And **UNIXWORLD** consistently offers the freshest, most down-to-earth writing that you'll find in any computer publication.

Subscribe today and receive the next 12 issues of **UNIXWORLD** for just \$18.00 – half the regular newsstand price. Save even more by ordering for two or three years. You can't lose – every subscription to **UNIXWORLD** comes with a no-risk guarantee\*.

**Subscribe now!**  
**Call toll-free:**  
**1-800-257-9402 ext. 29**



**If you're into UNIX, you need**

**UNIXWORLD**  
McGraw-Hill's Magazine of **OPEN SYSTEMS COMPUTING.**

**UNIXWORLD's no-risk guarantee:** If not satisfied, cancel and receive a full refund for the balance of your subscription.  
UNIX is a registered trademark of UNIX System Laboratories, Inc.

DH1AUW9



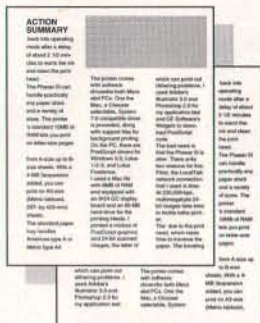
# BYTE Reprints

If you would like reprints of any article in BYTE, please contact:

Faith Kluntz  
 BYTE Reprint Department  
 One Phoenix Mill Lane  
 Peterborough NH 03458  
 Phone: 603-924-2525  
 Fax: 603-924-7620

for information and quantity prices.

Minimum order: 500



# BYTE

## RACING AT 33 MHZ

increases in processor, floating-point, and I/O throughput over earlier Macs (see the figure). Overall low-level performance is 28 percent higher than that of a Quadra 900. The standard Mac application test suite indicated better performance, too, with gains ranging from 9 percent to 21 percent. Because our word processing and desktop publishing application tests rely on two dated applications that suffer incompatibilities with the 68040's copyback cache mode (Microsoft Word 4.0 and Aldus PageMaker 4.0), we had to run these tests with the processor cache disabled. This skewed the results of these tests, making the 950 look slower than it really is.

The Rocket 33's software switches the processor cache mode on-the-fly. The two errant applications not only ran on the Rocket but ran about 60 percent faster than they did on the Quadra 900. For this reason, the Rocket 33's overall benchmark index is higher than that of the Quadra 950. The Rocket's win is tempered by its poor showing in the floating-point tests. Rocket 33 SANE (Standard Apple Numeric Environment) calls rely on the Mac's trap mechanism to route math computations to the Motorola transcendental math libraries. The trap mechanism adds significant overhead, which the Quadra 950's improved SANE calls bypass.

Because the copyback cache problem was introduced by the Quadra 700/900, most vendors have had time to fix problems. All my applications and special extensions, such as Shiva's NetSerial and Adobe Type Manager, worked fine on the Quadra 950. The latest versions of Word (5.0) and PageMaker (4.2) also run without disabling the processor cache and compromising performance.

For those who need top processing power, both the Quadra 950 and Rocket 33 deliver. If you're looking for a new high-speed Mac, the Quadra can't be beaten, even by a Rocket 33 in a Mac II. The Rocket is ideal for those who already own compatible Macs, but be aware that vintage machines with slow hard drives will degrade performance, and you may have to scrap all the RAM if it's rated slower than 80 ns. Mac IIci owners face the toughest choice, pondering whether to spend \$2499 for the Rocket 33 with its few incompatibilities or spend \$3499 for a Quadra 700 upgrade. I'd choose the Quadra for its fully integrated approach and its superior sound and video capabilities. ■

Tom Thompson is a BYTE senior technical editor at large with a B.S.E.E. from Memphis State University. You can reach him on BIX as "tom\_thompson" or on the Internet as tom@byteph.byte.com.



**Don't spend your time looking for information... Spend your time using it!!**

With ZyINDEX, you can find information contained in any document collection on network or stand alone computers in just seconds. **Quick, precise, fun; ZyINDEX** can search word processing, database or graphics files in plain english. Many output features. Powerful search tools: Word or Phrase; Boolean; Proximity; Synonyms and more... Powerful InfoApps features: HyperLink; Notes; Cut & Paste; Print; Launch...put your information to work for you. ZyINDEX works with WordPerfect, Word for Windows, dBase, graphics and other file formats. Developers API Toolkit available.



Call 1-800-544-6339 for free demo or update info

**ZyLAB**  
 Division of  
 Information Dimensions, Inc.

100 Lexington Drive • Buffalo Grove, IL 60089  
 Phone: (708) 459-8000 • Fax (708) 459-8054



# MICROSOFT AND BORLAND STAND BEHIND SMALLTALK/V.

If you're looking for the fastest, easiest way to develop and maintain applications, see Computerworld. That's where the major object-oriented languages were meticulously compared by actual customers.

For reusability of code and ease of maintenance, there was simply no comparison.

The under \$500 Smalltalk/V® outranked its \$3500 rival from ParcPlace Systems, and neatly outscored C++ from Microsoft and Borland.

With ratings like these, it's no wonder a company like IBM really does stand behind us.

## IBM TAKES A STAND.

Because of the leading edge technology and superior quality of Smalltalk/V, Digital is now one of only eight

COMPUTERWORLD  
BUYERS  
FORECAST

Product	Reusability of code
Digitalk's Smalltalk/V	8.5
ParcPlace Systems' Objectworks/Smalltalk	8.3
Microsoft's C++	7.9
Borland's C++	7.3

Ratings indicate user satisfaction.

COMPUTERWORLD  
BUYERS  
FORECAST

Product	Maintainability of code
Digitalk's Smalltalk/V	8.0
Microsoft's C++	7.7
Borland's C++	7.6
ParcPlace Systems' Objectworks/Smalltalk	7.5

Ratings indicate user satisfaction.

companies appointed to IBM's International Alliance for AD/Cycle. Which means Digitalk's Smalltalk/V is a key part of IBM's strategy for the 1990's.

It's not surprising, when you consider that our top-rated reusability of code is the essence of object-oriented programming. And that our unequaled ease of maintenance is the feature considered most

important by users in the Computerworld survey.

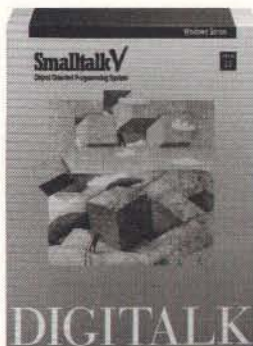
## DEVELOP FASTER.

Numerous case histories have shown that you can develop at least twice as fast with Smalltalk/V than with C++. Smalltalk/V is available for OS/2, as well as Windows, Macintosh and DOS. With easy portability across each platform.

And every application you deliver is 100% royalty-free.

To receive an informative white paper on Smalltalk/V object-oriented technology, call 1-800-531-2344. Please ask for Department 507.

If you're looking for the fastest way to develop applications, get behind the winning technology for the 1990's.



100% PURE OBJECTS.™

DIGITAL



# WE'RE ONLINE. AND IN LINE WITH YOUR OBJECTIVES.

BUSINESS WEEK

AEROSPACE DAILY

AIRPORTS

AVIATION DAILY

AVIATION WEEK &  
SPACE TECHNOLOGY

BIOTECHNOLOGY NEWSWATCH

BYTE

CHEMICAL ENGINEERING

CLEAN-COAL/SYNFUELS LETTER

COAL WEEK

DATA COMMUNICATIONS

ELECTRIC UTILITY WEEK

ENGINEERING NEWS-RECORD

HAZARDOUS WASTE BUSINESS

INDEPENDENT POWER REPORT

INDUSTRIAL ENERGY BULLETIN

INSIDE ENERGY/  
WITH FEDERAL LANDS

INSIDE F.E.R.C.

INSIDE N.R.C.

INTEGRATED WASTE MANAGEMENT

LAN TIMES

NUCLEONICS WEEK

POSTGRADUATE MEDICINE

PLATT'S INTERNATIONAL  
PETROCHEMICAL REPORT

PLATT'S OILGRAM NEWS

PLATT'S OILGRAM PRICE REPORT

S&P'S EMERGING & SPECIAL  
SITUATIONS

S&P'S REVIEW OF BANKING  
& FINANCIAL SERVICES

S&P'S REVIEW OF SECURITIES  
& COMMODITIES REGULATION

SECURITIES WEEK

TECH TRANSFER REPORT

UTILITY ENVIRONMENT REPORT

THE WEEKLY OF BUSINESS AVIATION

UNIXWORLD

AND MORE...

When you need business information, why not get the total story, instantly! Word for word. The McGraw-Hill Publications Online database gives you just that. Unedited, full-text retrieval (except graphics) of articles exactly as they are published in McGraw-Hill magazines and newsletters.

Now you can get information on companies, people and products on any topic — pertaining to one particular industry, or search the entire McGraw-Hill library (over 35 leading publications online) for diverse editorial perspectives. Only McGraw-Hill, the world's foremost business information publisher, can deliver it all so completely — immediately! McGraw-Hill unabridged.

Access an entire universe of business information. Go online with our line. McGraw-Hill Publications OnLine. For more information, including our latest list of publications, contact Andrea Broadbent at (609) 426-5523. Or fax this coupon to (609) 426-7352.

Or send it to the address below.

Available through Dialog®, Dow Jones News/Retrieval®, NewsNet® and Nexis®.

## McGRAW-HILL PUBLICATIONS ONLINE

Princeton-Hightstown Road  
Hightstown, NJ 08520 U.S.A.



Please send me the complete 1992 list of your publications online.

BY

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

Zip/Postal Code \_\_\_\_\_

Country \_\_\_\_\_

Tel. \_\_\_\_\_

GO ONLINE WITH OUR LINE.



## APPLICATION

## FrameMaker: Power Publishing for Windows

TOM YAGER

Fulfilling the needs of exacting document creators is Frame Technology's stock-in-trade. The company's latest effort brings its well-respected workstation-based document publishing system to a new platform: Microsoft Windows. FrameMaker for Windows is everything that version 3.0 is on the Unix and Macintosh platforms: a program that can be used to write, design, and print any kind of document. FrameMaker is uniquely scalable, applying its professional touch to everything from memos to books.

What FrameMaker brings—though perhaps not uniquely—to Windows-based publishing is an effective combination of ease of use and tremendous power. Preparing simple documents like business letters or reports is as easy in FrameMaker as in just about any GUI-based word processing package. You can choose from a broad set of templates that roughly match the type of document you plan to create. These are more than mere demonstration files; they are well-designed, professional-looking style guides for written communication. Frame Technology even provides an attractive letterhead template for business correspondence.

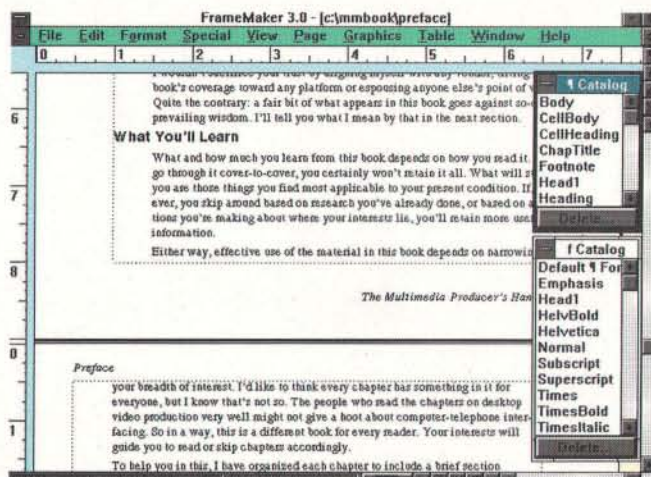
You use all the templates in the same manner: Delete the "filler" text and pour in your own. (The program has import filters to handle text from just about any word processor.) The templates cover every aspect of a document's appearance, from margins to font family to type size. They also include default paragraph- and character-format catalogs, similar to the style sheets in other publishing packages.

When you start pouring text into a template, FrameMaker does what a lot of other high-end publishing systems would like to do: collect text as effectively as a word processor does. Too often, capable document publishing systems are so poor at text entry that you're moved to use some other program for that. FrameMaker doesn't just do a bang-up job of formatting your text; it feels good and responsive as a text-entry system.

## Framed

If your work doesn't fit neatly within the constraints of the program's built-in templates (*constraints* is actually too strong a word, since you can change anything in

FrameMaker's document-editing window, showing the floating character- and paragraph-tag catalogs. The floating catalogs are handy for quickly applying fonts, type styles, and other attributes. But on a 640- by 480-pixel display, they crowd the screen's real estate.



any template), you need to venture into the more creative side of FrameMaker's personality. FrameMaker's name comes from its universal use of stretchable rectangular frames as objects for holding text or graphics.

A FrameMaker document can start either as a template that you customize to your needs or as a blank sheet of paper—whichever you prefer. Either way, shaping the document starts with drawing frames on the page to contain the information that you intend to add later. (You stretch a frame by clicking on one of its lines and then dragging the line until the box is the size that you want.) Frames are drawn on *master pages*, and you can have up to 25 of them within a document.

The best way to think of master pages is as backgrounds for documents. For a business letter, for example, you'd draw (using the program's built-in drawing tools) or import your company logo and other constant information to a master page and then stretch out a frame where you'd like the text of the letter's body to go. When you switch to the *body pages* to add your text, the elements you created on the master page appear, and the cursor jumps directly to the top of the text-entry frame you created.

If you want to change one of the master-page items, you can do so by switching back to master-page-editing mode at any time. This scheme makes it easy for a resident FrameMaker expert to create custom master pages—actually document templates—and place them in the hands of inexperienced users. These users can't accidentally change anything that was cre-

ated in the master page, but they can see it and get a feel, as they type, for how the finished document will look.

## Tagging Text

In addition to frames, FrameMaker depends on *tags*. These are names that get attached to groups of attributes that apply to either characters or paragraphs. You create a paragraph or character format tag by filling in a dialog box that includes a space for a unique name. Once you make the changes in that dialog box, the new format's tag name gets added to the appropriate character or paragraph catalog. FrameMaker lets you see these catalogs on-screen as floating windows containing scrolling lists (see the screen above). These catalogs are exquisitely simple to use: Just click on the name of the tag you wish to apply. If you select some text, the tag will be applied to what you've selected. Otherwise, the new tag will be applied at the insertion point, covering text you add from that point until you select the next tag.

This brings out one of the first things that makes FrameMaker a little harder to use than less capable tools. Because there's no easy way to trigger a new tag selection from the keyboard, you'll probably want to have the paragraph- and character-tag catalogs on-screen all the time, where they're easily accessible. FrameMaker lets you do that, but it takes up screen space. It's primarily for this reason that you're better off not running FrameMaker on a standard 640- by 480-pixel display. Even though there are buttons on the window border for popping up the catalogs, the tedium of reaching up there, calling up the catalog,



# Black Magic The new Aesthetics in Cherry Keyboards



**CHERRY** 

Electronics for the Future.

Cherry Mikroschalter GmbH, Cherrystrasse, P.O. Box 1220, D-W 8572 Auerbach/Opf., Phone: (0 96 43) 18-206, Telex: 631 635 cher d, Telefax: (0 96 43) 18

Cherry Electrical Products Ltd., Coldharbour Lane, Harpenden, Herts, UK-AL5 4UN, Phone: (0582) 763100, Telex: 826012, Telefax: (0582) 768

Cherry Sàrl, 1 Avenue des Violettes, Z.A., des Petits Carreaux, F-94384 Bonneuil/M. cedex, Tél.: 1-43-77-29-51, Telex: 262 657 cher f, Téléfax: 1-43-77-2



selecting the tag, and closing the catalog window proved more than I'm willing to suffer.

FrameMaker clearly shows its workstation roots here, running far more effectively on a 1024- by 768-pixel display that affords the space to keep the catalog windows visible all the time. Still, I consider it an oversight that FrameMaker doesn't allow you to create macros for common operations such as switching to and from italics. There are keyboard shortcuts, but they're awkward, multicharacter sequences fashioned after the EMACS editor, and they don't cover everything.

## Good with Long Documents

If you're writing a book or a lengthy technical document, FrameMaker is loaded with features made just for you. Many of the things that are optional in other packages are standard in FrameMaker. You can feed it volumes of text, and if you mark up the text properly, FrameMaker will generate tables of contents, indexes, and figures.

Instead of being stuck with a fixed mechanism, you can use FrameMaker's general-purpose list generator to create lists of any kind. This method works for glossaries, bibliographies, and reports. You can format these lists any way you like. When you generate a list, it's automatically placed in a separate document file so you can apply master pages, change tags around, and otherwise manipulate the file as you would any other document. FrameMaker's automatic list generation is one of its highlights.

Another highlight is FrameMaker's versatility in dealing with nontraditional types of documents. If, for example, you had to create a catalog in which certain items (e.g., prices and ordering information) changed depending on whether the reader was a retail or wholesale customer, other tools might force you to create two documents to cover the differences. FrameMaker covers you with *conditional text*, a special kind of tag that makes text invisible if a certain variable isn't set. Using this feature, you could have a single catalog document with conditional text that would let you choose whether the retail or wholesale version was to be printed. Similarly, conditional text will let you produce different versions of a document that vary according to language or regional custom. "Conditional text" is a bit of a misnomer, because almost any printable object, including bit-mapped graphics and tables, can be marked for conditional inclusion.

Another powerful aspect of FrameMaker is its handling of tabular material. The program can import text from any

source as a table. FrameMaker's table formatting capability provides almost limitless variety in layout. As with the rest of the package's features, if you're an experienced user, you can take the reins directly and do your own formatting. If you're less experienced, or just pressed for time, FrameMaker's defaults make sense and look great on paper. You can import table text from any delimited ASCII source, which makes it possible to pull in data from spreadsheets, database managers, or any application that lets you save

## BYTE ACTION SUMMARY

### ■ WHAT FRAMEMAKER FOR WINDOWS IS

A professional, cross-platform document publishing program that handles everything from memos to books.

### ■ LIKES

Templates provide quick access and ease of use for less demanding users, but FrameMaker scales itself remarkably well to tasks of any size; files are compatible with those from the Unix and Mac versions.

### ■ DISLIKES

The program doesn't always conform to Windows customs, and there should be some kind of keyboard macro facility; the interface is buggy in places.

### ■ REQUIREMENTS

A Windows-ready 386-based PC with at least 4 MB of RAM.

### ■ RECOMMENDATIONS

It's an excellent choice as a companywide document publishing system. It's quick and easy enough for creating memos, and its power makes even lengthy documents a breeze.

### ■ PRICE \$795

### ■ FOR MORE INFORMATION

Frame Technology Corp.  
1010 Rincon Cir.  
San Jose, CA 95131  
(408) 433-3311  
fax: (408) 433-1928  
**Circle 1070 on Inquiry Card.**

boards that are setting nical standards should reflect the mood of our

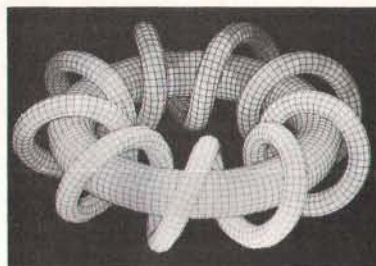
k Magic represents the gn alternative that many essional PC users are ecting from their modern i-function keyboards y. High-tech in black. lour variation that ches select interiors. k magic. new aesthetics in Cherry boards. d today for further techni- details!



able as compact keyboard and andard multi-function keyboard various layouts for different tries.



# Gain speed in your problem solving and confidence in your answers with Maple V...



3-D Tube Plot created with Maple V.

## The symbolic math software for engineering, science, and education professionals.

Maple, developed at the University of Waterloo, is today's most complete symbolic math package, and it's now available from MathSoft, the makers of Mathcad. Maple's comprehensive library of over 2,000 built-in functions and easy-to-use interactive environment delivers a maximum strength program in a surprisingly uncomplicated package.

### • Provides power and flexibility.

You won't believe that something so powerful runs on everything from supercomputers to computers with as little as 1MB of memory. And Maple's flexibility makes it easy to share files across all platforms. It's completely programmable... and Maple's user interface supports natural mathematical calculations, so you can request an infinite variety of computations and graph your output in two or three dimensions.

### • Use for a wide range of applications.

Maple is ideal for a wide range of applications, including helicopter blade design, VLSI design, chemistry, satellite guidance systems, econometrics, electrical engineering, and applied mathematics—to name just a few. Maple frees you from the "bookkeeping" of complex calculations and lets you concentrate on modeling and problem solving.

**Call us toll-free at 800-628-4223 or use this coupon to request more information on Maple.**

In Massachusetts call 617-577-1017 or fax this coupon to 617-577-8829.

### [ ] Yes! Tell me more about Maple.

Name \_\_\_\_\_  
Title \_\_\_\_\_  
Company or institution \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Phone (\_\_\_\_) \_\_\_\_\_

Mail this coupon to:  
**MathSoft, Inc.**  
201 Broadway  
Cambridge, MA 02139  
USA

## FRAMEMAKER

in ASCII. You can also include graphics (drawn or imported) in tables. Manipulating a table is almost as easy as working with a graphical spreadsheet.

FrameMaker's designers have chosen not to limit its number of potential users. Even the program's spelling checker is loaded with options, such as checking for double words, looking for bad hyphenation, and writing unrecognized words to a file for you to handle later. FrameMaker also has a component called FrameMath, a good set of tools for building WYSIWYG equations; this should appeal to anyone who has to compose mathematical or scientific manuscripts. The program is endowed with a capable markup language; unfortunately, the documentation for it is not included in the standard package.

It's impossible to cover all of FrameMaker's positive attributes in one short review, so I won't even try. I'll summarize it thus: I'm convinced that FrameMaker can do *anything*; it's just a matter of knowing how to ask.

### It Doesn't Feel Like Windows

Because FrameMaker is so packed with capabilities, it includes a help facility based on its own built-in hypertext engine. But FrameMaker's help isn't based on the familiar Windows help system, and therein lies the rub: While FrameMaker *looks* like a Windows application, it doesn't *feel* entirely like one. The proprietary help engine is only one example.

A non-Windows feel runs throughout FrameMaker for Windows. You press Alt-Arrow instead of Control-Arrow to move between words. Text fields in dialog boxes look like those in Windows, but they don't act the same. You often can't, for instance, sweep the cursor over a text field to select the text in it.

Sometimes the interface just plain behaves badly. For example, in the dialog boxes that you use to set up running headers and footers to create printed page-border data that changes according to the page's contents, the insertion point jumps around. You can click on the mouse to set it, and the blinking-line cursor appears, but when you start typing, the text gets added elsewhere. The same is true of deletions, which makes things dicey. In main-body text, the PageUp and PageDown keys navigate according to a printed page, not a display page, and the keys for moving to the beginning or end of a document are nonstandard.

The argument put forth by experienced FrameMaker users—and I am one of them—is that FrameMaker offers a predictable interface regardless of the platform it's running on. There's certainly an

advantage to that: If you make your company an all-FrameMaker shop, you can buy whatever hardware you like to run it, and even mix and match systems, and the program will be uniform across all of them. FrameMaker files are compatible across platforms, and all implementations can import graphics created elsewhere. The "FrameMaker feel" means you can sit down in front of anything that's running FrameMaker and immediately know how to use it.

While that's great if you're already a FrameMaker fan, it makes the package a little harder to fall for if you're a Windows user and you've grown accustomed to Windows programs. In many cases, there is simply no reason for Frame Technology not to add the Windows feel: Key combinations like Control-Arrow, Control-Home, and Control-End aren't mapped to anything. At least the developers could have double-mapped these keys to make moving between Windows applications easier.

In the long run, I find it unusual that FrameMaker, for its do-everything spirit, lacks the one thing that would make it a true cross-platform player: keyboard-mapping capability. The manual suggests using Windows' Macro Recorder (bleh) or a third-party macro facility to alter the keyboard map. But it also points out, rightly, that these macros aren't portable. Frame Technology should take on the responsibility of building a facility for redefining elements of the program's interface.

### Still the Best

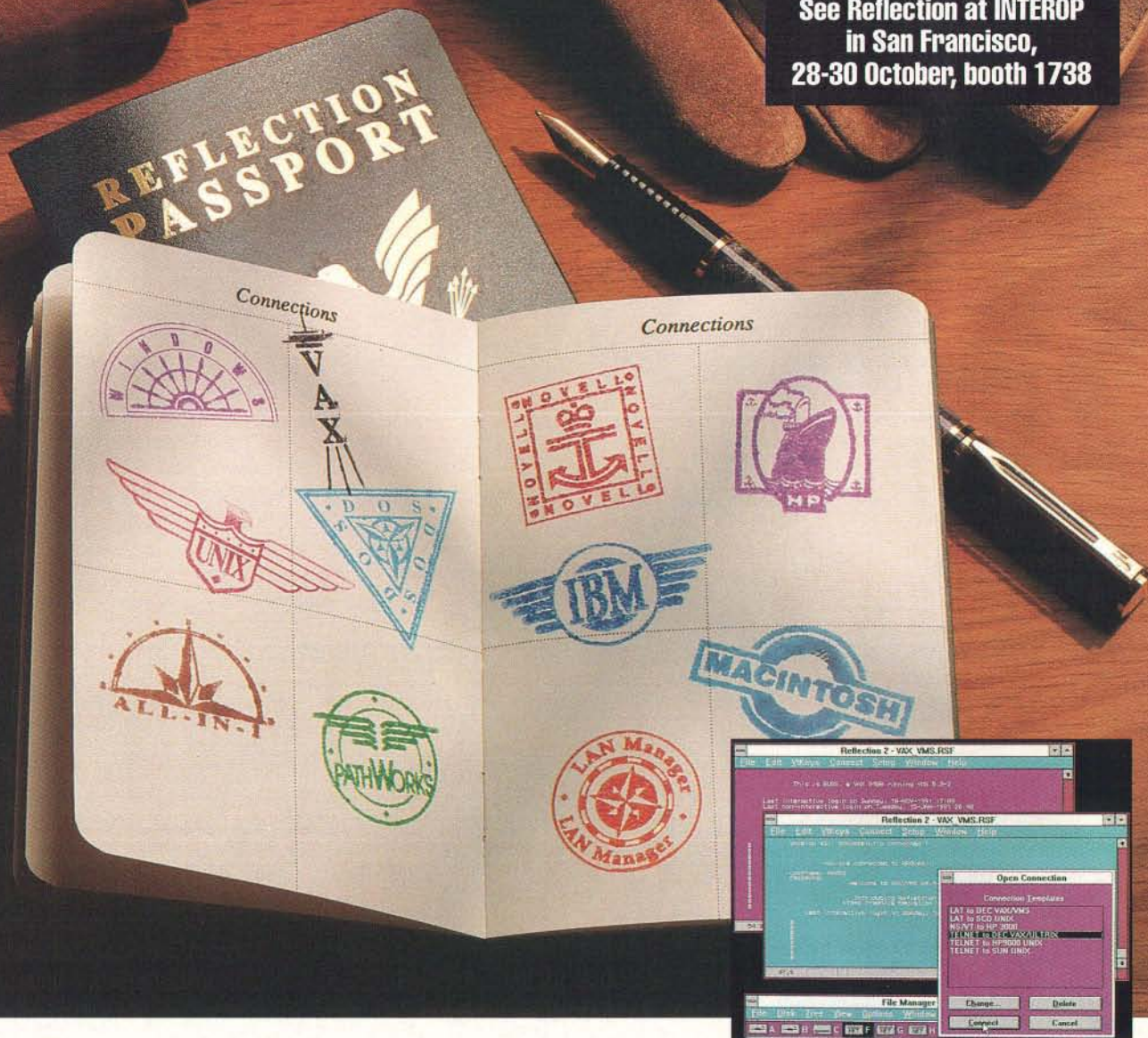
Landing on Windows opens FrameMaker up to its broadest potential audience. The program is an ideal solution for Windows users looking for an extremely powerful document-creation program. More important, the software now runs on all major platforms, so people in mixed-hardware offices can use it on their machine of choice and share files with coworkers who use other types of systems. While PageMaker can share files between its Windows and Mac versions, FrameMaker spans Windows, Unix, and the Mac.

It's impossible to work, as I have, with FrameMaker on four different platforms (Sun, Next, and Mac systems, and now Windows) without feeling a tremendous respect for it. ■

*Tom Yager is a BYTE technical editor and director of the BYTE Multimedia Lab. He is working on his second book, The Multimedia Producer's Handbook (Academic Press, forthcoming). He can be reached on BIX as "tyager" and on the Internet at tyager@byteph.byte.com.*



See Reflection at INTEROP  
in San Francisco,  
28-30 October, booth 1738



## Reflection: your passport to multivendor connectivity.

The computing world is changing. Now, Reflection® and the Reflection Network Series® software extend the reach of your desktop computers in multivendor environments.

Together, Reflection and the Reflection Network Series link all your systems. Reflection provides the user interface, offering the most precise VT and text and graphics terminal emulators for DOS, Macintosh, and MS-Windows. Reflection also delivers fast file transfer, keyboard mapping, and a powerful command language to automate the most complex tasks.

Using Reflection with the Reflection Network Series lets you work on host and server applications at the same time. Access is provided to Digital VAX, UNIX, HP, and IBM hosts, *concurrently*, along with Novell and other LANs. You can run multiple protocols simultaneously on a single PC, and switch among them without rebooting. Because protocols are loaded only as needed, memory is saved as well. It's the software solution that operates without a lot of additional hardware.

Reflection and the Reflection Network Series—the connectivity choices for a changing world.

ADE/F	(61) 73 32 49
Wick Hill IMX Ltd./GB	(0483) 772280
GFK Hamburg/D	(040) 23 73010
Salcom/SF	(90) 804 1789
Computing & Systems Consultants/NL	(040) 434 957
SIS Datenverarbeitung/A	(1) 376316
Sisostemi/I	(030) 2421074
Silicon/P	(1) 8151234
Scorpion Systems/E	(93) 485 40 44
Nocom AB/S	(018) 32 1090
Nocom Norge AS/N	(034) 70494
Bodeind/IS	(1) 612061
CommCare/CH	(01) 730 24 31
Megatec/AUS	(3) 874 3633
Brazil Software/BRA	(21) 240 3143
One to Seven Products/NZ	(9) 3580758
Singapore Computer Systems Pte. Ltd./SIN	441 2688
A-Line Technologies/B	(02) 718 3611
Tempest Europe/DK	(44) 94 89 02
Cybernet Systems/JPN	(03) 3982 3701

**REFLECTION**  
SERIES  
SOFTWARE

Walker Richer & Quinn, Inc.

2815 Eastlake Avenue East, Seattle, Washington 98102 / 206.324.0407 / FAX: 206.322.8151 / Zeestraat 55, 2518 AA Den Haag, The Netherlands / +31.(0)70.356.09.63 / FAX: +31.(0)70.356.12.44  
Reflection and Reflection Network Series are registered trademarks of Walker Richer & Quinn, Inc. All other trademarks are the property of their respective holders.

Circle 408 on Inquiry Card.

OCTOBER 1992 • B Y T E 250IS-1

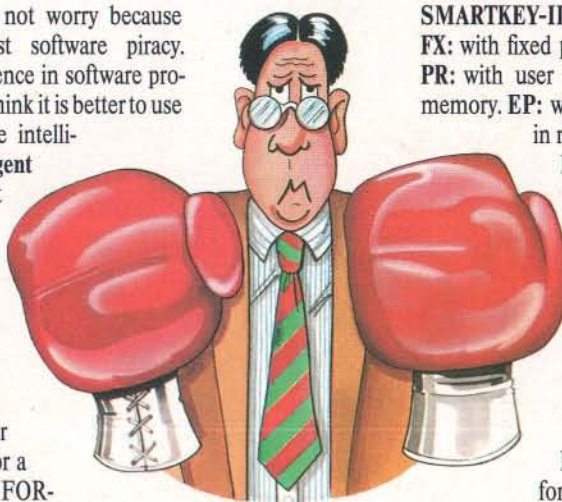


# THERE ARE OTHER WAYS FOR SOFTWARE PROTECTION

Take off the boxing gloves and do not worry because EUTRON will protect you against software piracy. EUTRON has a long and wide experience in software protection and it is for this reason that we think it is better to use intelligence than force; we mean the intelligence of SMARTKEY-II, an intelligent software protection key, planned against unlawful software diffusion.

SMARTKEY-II connects in a transparent way to the parallel port PC; a unique digital "signature" recognized by the software enables it to work; it is possible to protect directly and in few seconds the .EXE programs or to assume control of source codes for which are supplied software drivers for a great deal of languages (BASIC, C, FORTRAN, COBOL, PASCAL, CLIPPER, QUICK-

SILVER, etc.) and operating systems (DOS, XENIX, UNIX, WINDOWS3, NOVELL network etc.). In order to satisfy your needs the following



SMARTKEY-II models are available:

FX: with fixed pre-programmed access codes.

PR: with user programmable access codes and built-in memory. EP: with user programmable access codes, built-in memory and purpose-built counter to high-light fraudulent access attempts. Against the spread of piracy into environment up to now untouched, we have implemented the SMARTKEY-II SR model for the software protection on workstations, minicomputers or mainframes; due to the high security microprocessor, the key can be fitted on any computer supplied with a serial interface without the need of dedicated software drivers.

Do not hesitate to contact us for further information. Our technicians will be able to suggest you the best solution for your software protection problems. You will be surprised for the very cheap costs.

- No minimum orders needed.
- 24 hours order processing and delivery.
- Hot-line support available.



**DEALERS  
WELCOME**



**Eutron**

Via Gandhi, 12 - ITALY  
24048 TREVIOLO (BG)  
Tel. +39-35-690018  
Fax +39-35-692229

## SA-9600 Stand-Alone Radio Modem

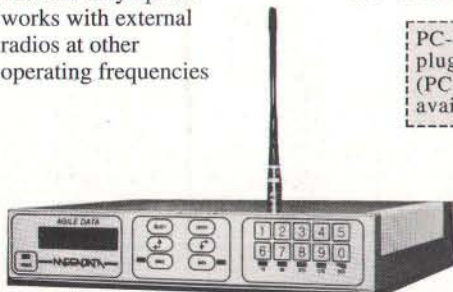
- ☐ Async/Sync RS-232 interface
- ☐ 2400, 4800, 7200, 9600 BPS
- ☐ Encryption capable
- ☐ Up to 15-mile range, hundreds of miles with repeaters/amplifiers
- ☐ Full or Half Duplex
- ☐ Voice and DC POWER options

up to 38,400 BPS async  
w/data compression option

## Wireless Data Communications for Micros, Minis and Mainframes

- ☐ Transparent radio link—no software modifications
- ☐ Modem-only option works with external radios at other operating frequencies
- ☐ 400-500MHz Band (FCC CERTIFIED 450-470MHz)

PC-compatible  
plug-in board  
(PC-9600) also  
available



**MEGADATA**

35 Orville Drive, Bohemia NY USA 11716

Tel: (01) 516-589-6800  
Fax: (01) 516-589-6858

## A MESSAGE TO OUR SUBSCRIBERS

FROM TIME TO TIME WE MAKE THE BYTE SUBSCRIBER LIST available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

**BYTE Magazine**

Attn: Subscriber Service  
P.O. Box 555  
Hightstown, NJ 08520





# MORE CACHE • LESS CASH

The Most Complete Line of Add-in Memory Boards for HP-Computers



## HP 1000 Series E, F

GFK749H-10	1 MB board
GFK749H-20	2 MB board

## HP 1000 Series A 400, 600, 700

GFK103X-10	1 MB board
GFK103X-15	1.5 MB board
GFK103X-20	2 MB board
GFK103X-40	4 MB board
GFK103X-60	6 MB board
GFK103X-80	8 MB board
Hood-Connectors	

## HP 1000 Series A 900, 990

GFK221X-40	4 MB board
GFK221X-80	8 MB board
GFK221X-160	16 MB board
GFK221X-320	32 MB board
Hood-Connectors	

## HP 3000 Series 9x7

GFK2231A-160	16 MB ECC module
GFK2232A-320	32 MB ECC module
GFK2511A-640	64 MB ECC module
GFK2516A-1280	128 MB ECC module <b>NEW</b>
GFK2230U-80	8 MB upgrade
GFK2230U-160	16 MB upgrade
GFK2230U-240	24 MB upgrade
GFK1793A-5	Extender-Card for 5 modules
GFK1793A-7	Extender-Card for 7 modules <b>NEW</b>

## HP 3000 Series 920, 922, 932, 948, 958

GFK1436A-160	16 MB ECC board
GFK1437A-320	32 MB ECC board
GFK1404U-80	8 MB upgrade
GFK1404U-160	16 MB upgrade
GFK1404U-240	24 MB upgrade

## HP 3000 Series 925, 935, 949

GFK1010A-80	8 MB ECC board
GFK1037R-160	16 MB ECC board
GFK1010U-80	8 MB upgrade

## HP 3000 Series 950, 955, 960, 980

GFK1104A-160	16 MB ECC board
GFK1152A-640	64 MB ECC board

## HP 9000 Series 200, 310, 320

GFK257A-05	512 KB board
GFK257A-10	1 MB board
GFK257A-20	2 MB board
GFK257A-40	4 MB board
GFK257U-05	512 KB upgrade
GFK257U-20	2 MB upgrade

## HP 9000 Series 318, 330

GFK258A-40	4 MB daughterboard
GFK258A-80	8 MB daughterboard
GFK258AU-40	4 MB upgrade

## HP 9000 Series 319

GFK266A-40	4 MB daughterboard
GFK266B-80	8 MB daughterboard
GFK266U-40	4 MB upgrade

## We're strong on Performance

### HP 9000 Series 332

GFK269A-10	1 MB daughterboard
GFK269B-40	4 MB daughterboard
GFK269U-30	4 MB daughterboard (trade in 1 MB)

### HP 9000 Series 340

GFK268A-40	4 MB board
------------	------------

### HP 9000 Series 345, 375, 380

GFK229A-40	4 MB ECC module
GFK229B-80	8 MB ECC module
GFK229S-160	16 MB ECC module
GFK229E-320	32 MB ECC module
GFK229AU-40	4 MB upgrade
GFK229SU-160	16 MB upgrade

### HP 9000 Series 350, 370

GFK258B-40	4 MB daughterboard
GFK258C-120	12 MB daughterboard
GFK258U-80	8 MB upgrade

### HP 9000 Series 360

GFK267A-40	4 MB daughterboard
GFK267B-80	8 MB daughterboard
GFK267C-120	12 MB daughterboard
GFK267U-40	4 MB upgrade
GFK267U-80	8 MB upgrade

### HP 9000 Series 382

GFK2200A-40	4 MB ECC module
GFK2201A-80	8 MB ECC module
GFK2202A-160	16 MB ECC module

- 10 years warranty
- Immediate Delivery
- Affordable Prices

## GFK HAMBURG · GERMANY

Frankenstraße 29 · 2000 Hamburg 1

Phone (40) 23 73 01-0

Fax (40) 23 17 89

## HP 9000 Series 8x7

GFK2231A-160	16 MB ECC module
GFK2232A-320	32 MB ECC module
GFK2511A-640	64 MB ECC module
GFK2516A-1280	128 MB ECC module <b>NEW</b>
GFK2230U-80	8 MB upgrade
GFK2230U-160	16 MB upgrade
GFK2230U-240	24 MB upgrade
GFK1793A-5	Extender-Card for 5 modules
GFK1793A-7	Extender-Card for 7 modules <b>NEW</b>

## HP 9000 Series 362

GFK2320-10	1 MB module
GFK2321-20	2 MB module
GFK2322-40	4 MB module
GFK2323-80	8 MB module

## HP 9000 Series 400

GFK229A-40	4 MB ECC module
GFK229B-80	8 MB ECC module
GFK229D-160	16 MB ECC module
GFK229E-320	32 MB ECC module
GFK229AU-40	4 MB upgrade
GFK229DU-160	16 MB upgrade

## HP 9000 Series 425 e

GFK2200A-40	4 MB ECC module
GFK2201A-80	8 MB ECC module
GFK2202A-160	16 MB ECC module

## HP 9000 Series 705, 710

GFK2216A-80	8 MB ECC module
GFK2217A-160	16 MB ECC module
GFK2218A-320	32 MB ECC module

## HP 9000 Series 720, 730

GFK1979A-160	16 MB ECC module
GFK2512A-320	32 MB ECC module
GFK2514A-640	64 MB ECC module <b>NEW</b>

## HP 9000/750

GFK1979A-160	16 MB ECC module
GFK1987A-320	32 MB ECC module
GFK2513A-640	64 MB ECC module
GFK2515A-1280	1280 MB ECC module <b>NEW</b>

## HP 9000 Series 820, 822, 832, 842, 852

GFK1436A-160	16 MB ECC board
GFK1437A-320	32 MB ECC board
GFK1404U-80	8 MB upgrade
GFK1404U-160	16 MB upgrade
GFK1404U-240	24 MB upgrade

## HP 9000 Series 825, 835, 845

GFK1010A-80	8 MB ECC board
GFK1037R-160	16 MB ECC board
GFK1010U-80	8 MB upgrade

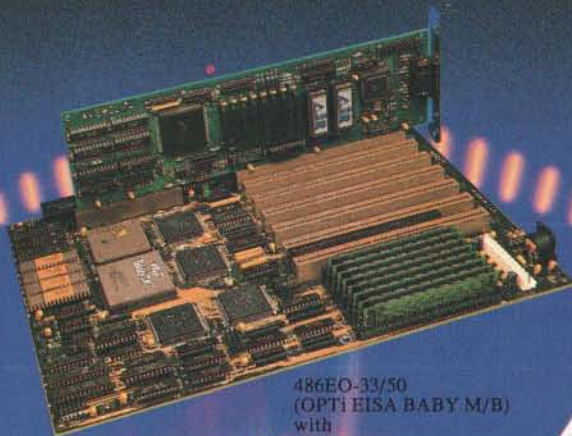
## HP 9000 Series 850, 855, 870

GFK1104A-160	16 MB ECC board
GFK1152A-640	64 MB ECC board

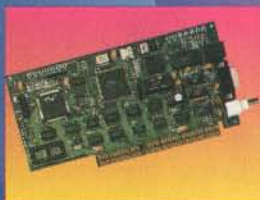


# EISA + Local Bus: A New Level of Performance

**AIR** : THE EISA PIONEER SINCE APRIL 1990



486EO-33/50  
(OPTi EISA BABY M/B)  
with  
A VIEW-2L  
(Local Bus S3 VGA Accelerator)



EISA ETHERNET CARD  
A-NET E1



486 BP-33/50  
(486 ISA CPU card)  
\* IDE, FDC, 2S + 1P on Board  
\* support Local Bus VGA  
with B P-9  
(Back Plane slot Board)



EISA SCSI-E1  
(EISA Intelligent SCSI-II)

An ordinary computer company can be many things, but at AIR, we believe that to be the leader, we have to be first, fast, and should constantly offer a new degree of performance. AIR was one of the first with an EISA mainboard as early as April 1990, when others were still wondering what it stood for. Today, we offer you the latest in EISA technology. The AIR 486 EO-33/50 is an EISA baby-sized Mainboard that's small in size but max on features and expansion options, and supports one Local Bus slot. Our AIR SCSI-E1 is a 32-bit intelligent SCSI host adaptor that confirms to the SCSI-II protocol, with a 10Mb/s data transfer rate, and a 16Mb/s (33 Mb/s in burst mode) bus transfer rate. Our EISA Ethernet cards confirms to the NE3200 architecture for excellent performance / cost ratio due to a high-performance system architecture and a dual-chip solution, making it ideal for workstation and file server applications. Our A view 1L & 2L VGA cards utilizes our Mainboard's 32-bit Local Bus VGA that enhances the performance of the regular displays from the standard I/O bus for a new level of video performance.

The AIR name is now recognized the world over for advanced products that carry with its quality and reliability. Our boards are the workhorses behind many leading international PC brands. Not many can claim to a reputation that has been recognized by the industry's most respected publications: BYTE & PC Magazine.

#### New products release:

1. Local Bus full series
2. Industrial 486 ISA CPU card series.  
\* support Local Bus \*
3. Full series EISA with Locus Bus.



Manufacturer & Exporter  
**UNITED HITECH CORPORATION**  
7F-1, No. 1 Wuchuan 1 Rd.,  
Hsinchung City, Taipei-hsien, Taiwan, R.O.C.  
Tel: 886-2-299-3125/30 Fax: 886-2-299-3210

In the U.S., please contact:  
**ADVANCED INTEGRATION RESEARCH, INC.**  
2188 DEL FRANCO STREET SAN JOSE, CA 95131  
Tel: (408) 428-0800 Fax: (408) 428-0950

Distributors  
**SINGAPORE:**  
**WEALSOFT COMPUTER SERVICES PTE. LTD.**  
Tel: (65) 2988298 Fax: (65) 2972218

**INDONESIA:**  
**P.T. BHINNEKA DATA PROSES**  
Tel: (62) 021-4899835 Fax: (62) 021-6399061

**GERMANY:**  
**STUTTGART:**  
**NP COMPUTER SYSTEME GmbH**  
Tel: (49) 0711-629010 Fax: (49) 0711-6210030

**U.K.:**  
**GETIN**  
Tel: (44) 0923-233737/239705  
Fax: (44) 0923-250139

**COMDEX / Fall '92**  
16-21 November, 1992  
Las Vegas, Nevada, U.S.  
SAND Convention  
#S2894

**FINLAND:**  
**MICRODATA OY**  
Tel: 358-0-4582211  
Fax: 358-0-4582020

**SPAIN BARCELONA:**  
**BX SISTEMES**  
Tel: (34) 93-5820208  
Fax: (34) 93-5820209

Circle 406 on Inquiry Card (RESELLERS: 407).

All brand names and Trademarks belong to their registered companies.



## SYSTEM

# Cyrix Cx486SLCs Hit the Desktop

ROGER C. ALFORD

**C**yrrix is the latest of a growing list of companies to provide microprocessors for the lucrative, high-volume PC marketplace. Over past years, Cyrix has become well known for its high-performance math coprocessors, which are now available for every speed and flavor of Intel's and AMD's 386 CPU offerings: DX, SX, and SL. In March, Cyrix announced its move into the CPU arena with the introduction of its Cx486SLC processor.

Tandon and Zeos are two of the first companies to incorporate the new 25-MHz Cyrix processor into their desktop machines. In this review, I'll take a look at the Tandon Option 386SLC/50 and the Zeos 486SLC-25 with an eye toward how the Cx486SLC contributes to the performance, compatibility, and pricing of these two systems.

### On the Inside

Tandon's Option system has been on the market for nearly a year. It's an upgradable design featuring a modular processor cartridge that slides in through the system's front panel. Option owners upgrade their systems by purchasing new cartridges as new processors become available. This architecture obviously played an important role in Tandon's ability to deliver one of the first Cx486SLC-based systems.

Tandon calls its 25-MHz Cx486SLC processor cartridge a 386SLC/50—an unfortunate choice, in my opinion. The company claims the name, which implies that the system includes a 50-MHz version of a 386SLC (i.e., a cached 386SX built by IBM), reflects the system's performance most accurately and will simplify choices for less informed purchasers. I think it will only further confuse the many consumers who are already bewildered by the large variety of processor offerings.

The Tandon Option system comes standard with 4 MB of DRAM, two floppy drives (one of each standard type), two serial ports, a parallel port, an integrated 512-KB Super VGA video controller, and a fax/modem board, all for a base price of \$994; this price does not include a processor cartridge. The system also comes with DOS 5.0, Windows 3.1, Microsoft Works for Windows, a mouse, and a 30-day Prodigy start-up kit. My review system had an additional 4 MB of DRAM, a re-



*Tandon's Option 386SLC/50 (left) and Zeos's 486SLC-25 are the first desktop systems to include Cyrix's 486-compatible Cx486SLC.*

## BYTE ACTION SUMMARY

■ **WHAT CX486SLC SYSTEMS ARE**  
486-compatible systems built around Cyrix's Cx486SLC processor.

■ **LIKES**  
Very attractive prices; solid compatibility.

■ **DISLIKES**  
Performance could be improved with an external cache.

■ **RECOMMENDATIONS**  
Tandon's Option 386SLC/50 offers the best combination of price, performance, and features.

■ **PRICE (AS TESTED)**  
Tandon Option 386SLC/50, \$2770  
Zeos 486SLC-25, \$2174

■ **FOR MORE INFORMATION**  
Tandon Corp.  
405 Science Dr.  
Moorpark, CA 93021  
(800) 826-2660  
(805) 523-0340  
fax: (805) 378-7823  
**Circle 1068 on Inquiry Card.**

Zeos International, Ltd.  
530 Fifth Ave. NW  
St. Paul, MN 55112  
(800) 423-5891  
(612) 633-4591  
fax: (612) 633-1325  
**Circle 1069 on Inquiry Card.**

movable 200-MB hard drive, a 14-inch color monitor, and a 386SLC/50 processor cartridge with a Cyrix math coprocessor. My system's price was \$2770.

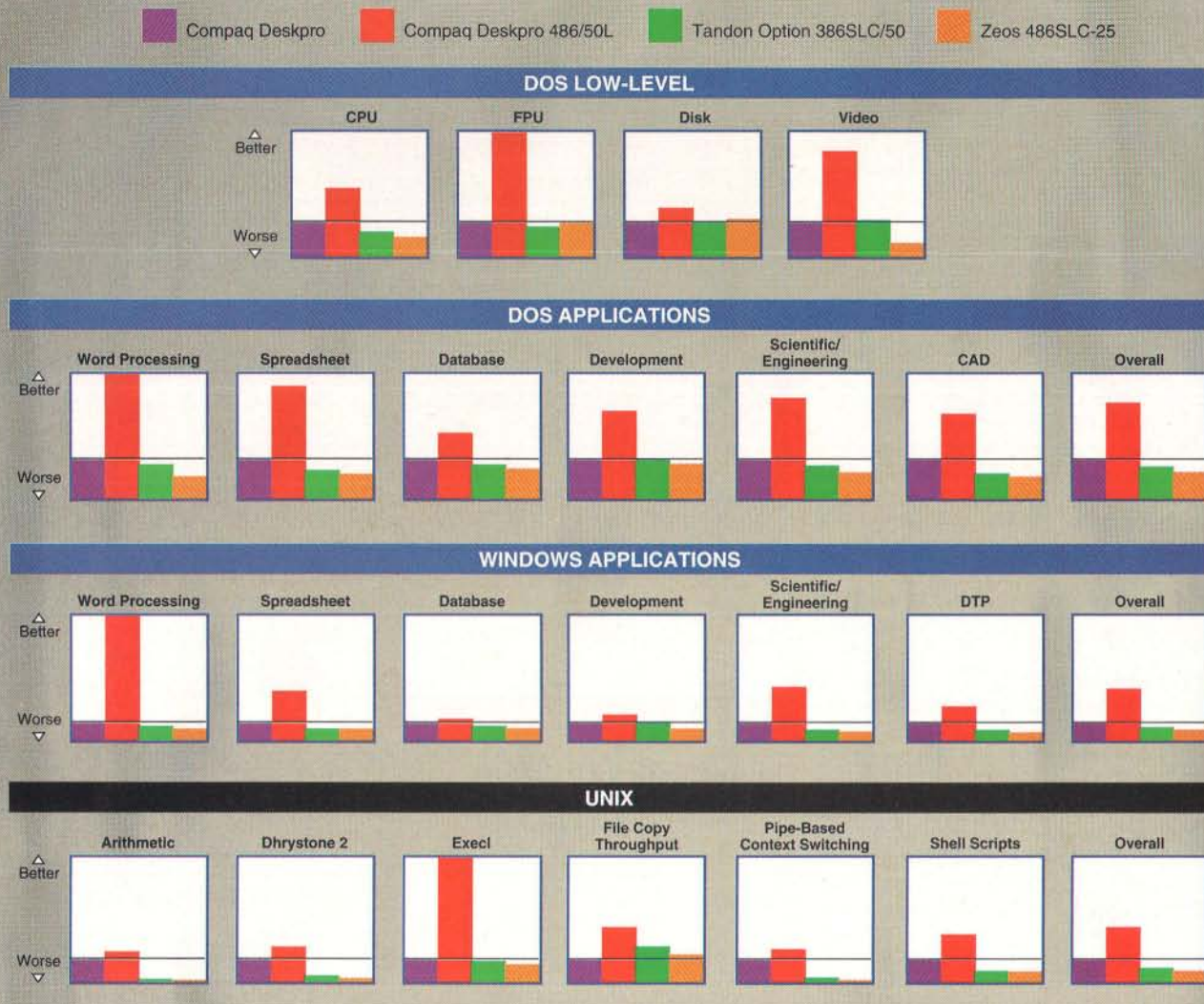
Oddly, the Tandon Option lacks DRAM parity checking. Therefore, the system can't verify memory integrity during normal operation. Tandon maintains that the

BIOS does a complete memory test at power-up, so parity checking is unnecessary. But with the amount of memory being used in today's systems steadily increasing, the absence of parity checking seems to be a notable drawback.

The Zeos 486SLC-25, with its large seven-drive-bay desktop case, is a more



## BYTE BENCHMARK INDEXES



All results are indexed, and higher numbers indicate better performance. For each index in the DOS and Windows tests, a Compaq Deskpro 386/33L running Compaq DOS 5.0 and Windows 3.0 = 1. For each index in the Unix tests, a Sun Sparcstation IPC = 1. The overall index is the average index of the individual tests.

The BYTE low-level benchmark suite identifies relative performance at the hardware level, breaking down performance by system component. The results of these tests can help you to identify the relative performance of a given subsystem and to determine where performance bottlenecks may lie. For a complete description of these tests, see "BYTE's New Benchmarks: New Looks, New Numbers," August 1990 BYTE. The BYTE low-level benchmarks, version 2.2, are available in the byte.bmarks conference on BIX, or you can contact BYTE directly.

BYTE's application performance suite measures the performance you can expect to see running a given application category under a given operating environment. We test under two en-

vironments: DOS 5.0 and Windows 3.0. We test six application categories for each environment, running test scripts using the following programs: Word Processing: WordPerfect 5.1 and Lotus Ami Pro 2.0; Spreadsheet: Lotus 1-2-3 release 3.1+ and Microsoft Excel 3.0a; Database: Software Publishing Superbase 4 version 1.3 and Borland dBase IV; Development: Borland Turbo Pascal for Windows and Microsoft C 6.0; Scientific/Engineering: MathSoft MathCAD for Windows 3.0, The MathWorks MatLab 3.5k, and Computing Resource Center Biturbo Stata 2.1; CAD: Autodesk AutoCAD release 11; and Desktop Publishing: Aldus PageMaker 4.0. The data files and test scripts are available from BYTE.

Our Unix tests show relative performance for double-precision arithmetic, the Dhystone 2 benchmark, spawning a process (execI()), file copy throughput, pipe-based context switching, and running a shell script with eight concurrent scripts running. Unix benchmarks are available on Usenet, from Demolink, in the listings area on BIX, or on disk.

*The benchmark results show that the performance of 25-MHz Cx486SLC systems lies somewhere between that of 25- and 33-MHz 386 systems. Of the two Cx486SLC machines, the Option 386SLC/50 is clearly faster.*

traditional box. My review unit came with 4 MB of DRAM, a 107-MB hard drive, a Diamond Stealth 1-MB Super VGA adapter, a 14-inch color monitor, a game port, and the same basic I/O ports and floppy drives as the Tandon Option. The Zeos 486SLC-25 also comes with DOS 5.0,

Windows 3.1, a choice of two Lotus application programs, a mouse, and a Cyrix math coprocessor, for a total cost of \$2174. Upgrading to a 240-MB hard drive and 8 MB of RAM, a configuration that more closely matches that of the Tandon Option, brings the total system cost to \$2583.

To challenge the compatibility of the Cx486SLC processor, I put the two machines through rigorous software testing beyond that of BYTE's already-comprehensive DOS, Windows, and Unix benchmarks. First I tried numerous DOS and Windows applications with no problems.



Even with Windows operating in 386 enhanced mode and while running multiple applications simultaneously, both systems worked flawlessly. Multiple DOS boxes under Windows were no problem, and even my sometimes-fickle Battle Chess program had no problems running in a Windows 3.1 DOS box.

I next installed OS/2 2.0 to give the systems a try in a true multitasking environment. OS/2 ran smoothly, with both OS/2 and DOS applications running well.

As a final test, I enlisted the help of an associate who is intimately familiar with QNX, a real-time Unix-like operating system from Quantum Software Systems. After repartitioning the hard drives, we installed QNX on both systems; both ran fine. We compiled QNX applications and ran them, and then we ran DOS applications using QNX's *rundosp* utility.

### Benchmarks Say...

The results of the BYTE benchmarks are shown in the figure. I also compared the low-level benchmark results of the machines reviewed with those of a Compaq 386/25e and a Tandon 486/25 (which uses a 25-MHz Intel 486DX processor) to see where the Cyrix-based systems fit in (not shown). From a pure CPU-horsepower standpoint, the Cyrix processor clearly outpaces the 25-MHz Intel 386DX. It is also apparent that the 25-MHz Cx486SLC is somewhat slower than the 33-MHz i386DX (used in the Compaq 386/33L) and the 25-MHz 486 (used in the Tandon 486/25). Thus, Cyrix appears to have carved out a niche between the 386/25 and 386/33 processors with its initial CPU offering.

Interestingly, the fast 25-MHz Cyrix math coprocessor in the reviewed systems competes very favorably with the 33-MHz Intel 387 in the Compaq 386/33L. The Zeos 486SLC-25, with an FPU index of 0.99, shows essentially equivalent performance, while the Tandon Option 386SLC/50's is slightly slower at 0.85.

Of the two Cx486SLC-based systems, Tandon's Option was clearly the overall performance leader. It outshone the Zeos 486SLC-25 in the low-level CPU and video benchmarks and in virtually all the application-level benchmarks. However, Zeos's system eked out slightly better low-level FPU and disk benchmark results, allowing it to show a small performance advantage in the Windows spreadsheet index.

It looks like Cyrix's engineers did their homework in developing the Cx486SLC. After my rigorous applications testing with multiple operating systems, not the least hint of a compatibility problem revealed itself. And while it may maintain the foot-

print of a 386SX, the Cx486SLC definitely outruns the 386SX/DX processors (operating at the same clock rate) according to the BYTE tests.

The Tandon Option 386SLC/50 and Zeos 486SLC-25 are both solidly built machines. They rely exclusively on the Cx486SLC to provide improved performance; perhaps an additional external cache would make for better-optimized designs.

Of the two, the Tandon Option 386SLC/

50 stands out as the better performer. And despite its misleading name, it offers a very attractive price for the total package, especially factoring in its easily upgradable CPU module and removable hard drive. ■

*Roger C. Alford, a BYTE consulting editor, is president of Programmable Designs, a Michigan-based consulting firm specializing in electronics design. He can be contacted on BIX as "rogera."*

## PUT AN END TO SOFTWARE PIRACY!

Meet the growing family of security keys from Software Security.

Each one a specialist at enforcing your license agreement in virtually any user environment you can think of. Whether it's DOS, UNIX, Macintosh or OS/2. Whether it's a single user installation or a LAN.

Simply connect the appropriate key to a single user computer, or a non-dedicated file server in a network, and you control all access to your protected application.

Users, however, won't even know it's there. The keys are transparent and won't impact software functionality or the ability to make back-up copies. Normal node and LAN operations are unaffected.

### The Ultimate Protection For Software Publishers

NOW AVAILABLE!  
NETWORK  
PROTECTION  
WITH REMOTE  
UPDATING!

Please see us at  
**COMDEX/Fall**  
Booth #8244

Simple. Unassuming. Ever vigilant. Easy to incorporate into your application package. And quite possibly the most profitable hardware investment a software developer can make.

To find out more, call:

**1-800-841-1316**

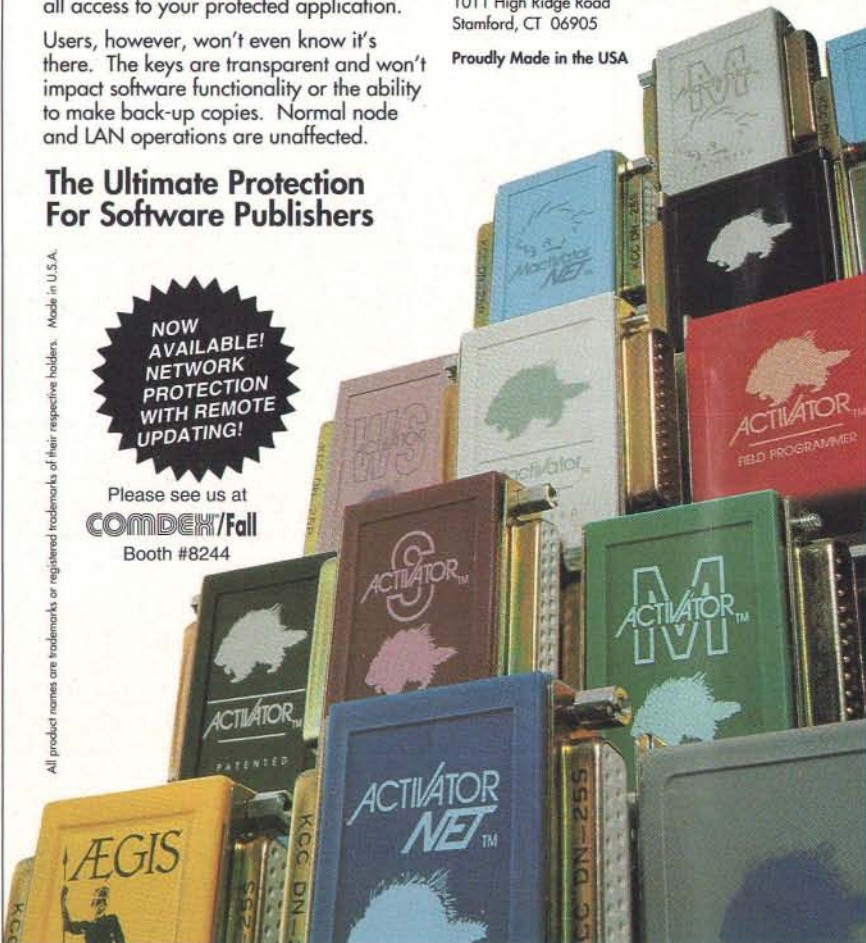
IN CONNECTICUT CALL: 203-329-8870  
FAX 203-329-7428  
EUROPE AND UK: +44 784 43 00 60



**SOFTWARE SECURITY INC.**

1011 High Ridge Road  
Stamford, CT 06905

Proudly Made in the USA



North American Readers circle 165; Other Readers Worldwide circle 166



## A Universal Solution for PC SCSI?

COREL INSTALL V2.00a Monday, July 13, 1992 5:12 pm

Drive	Capacity	Physical	DOS3	DOS4
1. MOST 3.5 REWRITABLE	120MB	512	2048	NONE
PANASONIC LT-3000 REWRITE	120MB	512	2048	NONE
PANASONIC LT-5010 WORM	940MB	1024	8192	1024
PANASONIC LT-5000 WORM	400MB	512	3872	NONE
PANASONIC LT-9000 REWRITE	600MB	512	5120	NONE
PANASONIC LT-9000 REWRITE	650MB	1024	6144	1024
PANASONIC LT-7010 MULTI	1GB	1024	8192	1024
PIONEER WORM	650MB	512	5120	NONE
PIONEER MULTIFUNCTION	650MB	512	6144	NONE
RICOH REWRITABLE	600MB	512	5120	NONE
RICOH REWRITABLE	650MB	1024	6144	1024
RICOH REMOVABLE	50MB	512	1024	NONE
MAXTOR/RICOH 800 WORM	800MB	2048	6144	2048
SHARP REWRITABLE	600MB	512	5120	NONE
SHARP REWRITABLE	650MB	1024	6144	1024
SONY 3.5 REWRITABLE	120MB	512	2048	NONE

Press: Q17 for HELP, Q100 for right mouse button for the previous screen

*CorelSCSI supports an impressive array of SCSI devices, including all current ASPI controllers. The devices are selectable from the software pick list shown here.*

On our way to testing removable storage products for this month's Solutions Focus (see page 198), we sought our own solution: how to test drive mechanisms independently, apart from the influence of adapters and software drivers. This raised the more general problem of how to deal with SCSI on the PC.

Although the Macintosh provides a standard hardware and software interface for SCSI devices, PC-class systems are faced with a wealth of confusing options. Most of the removable-media devices we reviewed provided their own SCSI boards and drivers. Few provided a standard interface that would allow other devices to share the same SCSI platform. Aside from presenting a configuration nightmare, special-purpose drivers no longer respond to real-world needs. SCSI, after years of quiet growth, is catching on as a useful PC interface for CD-ROMs, tapes, and optical scanners, as well as the various types of removable media.

### A Level Playing Field

To provide a level testing environment, we connected all our test media to a single SCSI board. The environment we chose for the project was an Adaptec 1542B interface board and the CorelSCSI software drivers. The SCSI board was configured not to load any of the attached SCSI devices at boot time. The ASPI (advanced SCSI programming interface) driver was loaded for communication with the SCSI board. ASPI is an interface to the SCSI hardware that allows multiple device drivers to communicate through the same hardware. Developed by Adaptec, it is now available through other manufacturers.

The CorelSCSI device drivers load on top of the ASPI driver. CorelSCSI can then control any device driven by ASPI software. If you are only going to use some plain-vanilla SCSI devices, you probably don't require the CorelSCSI software, since the drivers provided by Adaptec work quite well. The difference is the Corel goal of universal hardware support.

The stated goal of the CorelSCSI software is to create drivers for every conceivable SCSI device to ensure that they can all work together without conflict. Currently, this support extends to magneto-optical media, CD-ROMs, write-once optical drives, jukeboxes, and tape drives. CorelSCSI also supports Kodak Photo CDs, allowing any Extended Architecture-compliant CD-ROM drive to read Photo CDs directly. Drivers are provided for DOS, Windows, OS/2, and Novell NetWare (although not all drives are supported in all environments). You can call Corel and receive a list of all currently supported drives and environments. A partial list is displayed in the screen.

### Some Surprises

In our test setup, we disabled the on-board Adaptec SCSI BIOS and managed all device communications using just the Corel drivers. We were pleased to discover we could quickly configure a setup with widely varying drives. We strung magneto-optical, CD-ROM, and removable-media drives together, and the installation software recognized them all and provided the proper driver. A reboot after installation provided immediate access to the drives that contained preformatted media. The CFormat command quickly formatted the

remaining devices. It was a simple, and elegant, solution.

What did surprise us was the lack of setup support for standard SCSI hard drives. The Corel installation consistently came back with a "drive not found" error when we attempted to add a Quantum drive to the SCSI chain. In fact, it finds it; it simply cannot recognize it. Further exploration revealed that CorelSCSI does not recognize any standard SCSI hard drives. Performing a manual configuration (we told it the drive was a removable SyDOS) solves the problem. This, however, is a queer oversight for a system purporting to support "all available SCSI devices." According to Corel technical support, you are expected to use the drivers provided with your SCSI card to support the standard drives. This can get rather confusing, not to mention the added waste of yet another driver crowding into your cramped memory space.

We ran into another problem when communicating with a Procom floptical drive. Although the CorelSCSI software automatically recognized the drive, we couldn't format standard 720-KB and 1.44-MB floppy drives. Since this is one of the strengths of the optical technology, it was a great disappointment not to be able to take advantage of it.

Corel plans to bundle the CorelSCSI software with Adaptec adapters. It looks like a good combination to us. There are still some kinks to work out, but the strategy is a solid one. Aside from the omissions mentioned, the CorelSCSI software let us quickly and painlessly swap drives on and off our test systems without hindrance. In fact, it became rather transparent, just as good tools should be. ■

—The BYTE Lab

## COMPANY INFORMATION

### Corel Systems Corp.

1600 Carling Ave.  
Ottawa, Ontario,  
Canada K1Z 8R7  
(800) 836-7274  
fax: (613) 728-9790

**Circle 1221 on Inquiry Card.**

### Adaptec, Inc.

691 South Milpitas Blvd.  
Milpitas, CA 95035  
(408) 945-8600  
fax: (408) 262-2533

**Circle 1222 on Inquiry Card.**



# THE ALTERNATIVE TO 60 DAYS OF HARD LABOR.



These days, you can spend far too much time investigating, gathering, digesting and organizing technical data. Which is why there's Datapro. We distill all the material you need to make smart decisions about information technology. Our reports, available in print and electronic formats, are timely. Thorough. Accurate. And objective. The last word on the subject. For a free sample report, call us today at 800-328-2776, Ext. 2777, or mail or fax this coupon. Unless you actually enjoy doing unnecessary work.

Name \_\_\_\_\_  
Title/Dept. \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Phone \_\_\_\_\_

**DATAPRO** *The last word.*

Datapro USA • 600 Delran Parkway, Delran, New Jersey USA 08075 • Tel: 609-764-0100 Fax: 609-764-2812  
Datapro International • McGraw-Hill House, Shoppenhangers Road, Maidenhead, Berkshire, England SL6 2QL • Tel: +44 (0) 628 773277 Fax: +44 (0) 628 773628

FREE sample report on workgroup computing.





# BOOK AND CD-ROM REVIEWS

HUGH KENNER

To humiliate a world-class chess-playing machine, try proposing a round of tic-tac-toe. Expert at one "fragment of high human competence," Belle or Deep Thought proves nonetheless "very brittle," unable to expand the concept of "game," incapable even of *looking* at the chessboard on which we pretend it's expert. That's been a recurrent complaint about AI projects: dependence on rule systems so special-case it's stretching things to mention "intelligence."

Contrast the approach of a man named Stewart Wilson, who writes, "By stimulating and understanding complete animal-like systems at a simple level, we can build up gradually to the human." (Then perhaps further upward to chess, thence to the chess whiz, a special case of "the human"?) Thus, "We hope to reach human intelligence from below instead of piecemeal through high-level competences." Equipped with the right mix of simpler aptitudes, our gadget will *learn* the advanced ones (or learn to learn them).

Wilson is speaking on behalf of what's been miscalled "artificial life": miscalled, because of the myriad irrelevancies in which that phrase can entangle thought; notably, "Is life thinkable without protoplasm?"

Come in from another direction. In a computer run of many hundred generations, artifacts can grow and learn, can even manifest skills no programmer ever taught them. Life? Yes, but (some cry) doesn't that program merely *simulate* life, which requires a medium other than silicon? No, cry others; as long as that program is running, what's inside the computer *is* alive: *is* life.

Such wranglings are dreary, and I could wish that Steven Levy had laid out his *Artificial Life: The Quest for a New Creation* so they'd not bedevil his opening pages. Readers may prefer to start with chapter 6, "The Genetic Algorithm," proceed to the end, and loop back to chapter 1, rather than read Levy's book straight through.



## IS ARTIFICIAL LIFE POSSIBLE?

**Artificial Life: The Quest  
for a New Creation**

Steven Levy  
Pantheon, \$25,  
ISBN 0-679-40774-X

The genetic algorithm in effect uses evolution to optimize something naive. "One of the first used GA's to seek strategies in an extremely simplified version of chess." Contrast that with AI's papa-knows-best procedure of just writing in the best strategies available. The AI program can never know more than papa does. But there's no reason a GA mightn't happen on maneuvers no Grand Master has hitherto glimpsed.

Evolution is learning conducted over many generations. Millions of years? Well, computer generations can flicker by quickly; it's even feasible to recommence, as it were from the Day of Creation, again and again. Why? Well, to satisfy yourself that chance, judiciously applied, didn't just happen to solve the problem once but will *always* solve the problem, if not always in the same way.

A sample: Here's a "trail" of 89 squares, twisting and turning, with gaps increasingly frequent and increasingly long. A creature that can see only one step ahead must rely a good deal on chance to reach the trail's end. We next turn loose 65,536 such creatures and offer them 200 moves each. While most accomplish nothing of note, a few will stay on track for as many as four squares. We discard all but the top 10 percent, pair those at random, interbreed them....

And lo, after but 20 generations, the average "ant" can navigate some 30 squares. By 70 generations, "the population is loaded with smart ants," a surprising number of whom have managed the entire 89-square trail. One organism that myriad trials produced was "Champ 100," with "devilishly efficient" logic exquisitely tailored to the problem. "An impressive creature," Levy remarks, "even more so because no one programmed it": only "the incremental wisdom of natural selection." ■

*Hugh Kenner is Franklin and Callaway Professor of English at the University of Georgia. His recent books include Mazes and Historical Fictions. You can contact him on BIX as "hkenner."*

## VISUAL ATTRACTION

In the short time since its release, I've developed into something of a fan of Microsoft's Visual Basic (VB). I was fortunate enough to receive four books on the subject. The first of these, *Visual Basic for Windows Inside & Out*, is a beginner's book that suffers from a chronic lack of direction, jumping from subject to subject. It claims to cover the full range of VB's capabilities, but the chapter on DDE shows VB only as a client, and there are only three pages on interfacing with DLLs. And even though this is the only book with content specific to the Professional Toolkit, that chapter is only a laundry list with no examples.

The better beginner's book is *Visual Basic by Example*. While the overly loud layout gave me a headache, the book's

organization and presentation are superb. It gives beginners just what they need: a tour, with brief examples, of all VB's major features. This book has a fun, nonintimidating style clearly aimed at nonprogrammers. There is a chapter on more advanced topics at the end, but it's short and confusing. Still, this book, with the available floppy disk, is the best way I've seen yet to learn VB from scratch.

The other two books target an audience that's programmed before, if not already in Visual Basic. I was both pleased and disappointed with *Visual Basic Power Programming*. I was impressed with the sections on data structures like lists, sparse arrays, and hash tables. What turned me off was that much of the book seemed to be rehashed QuickBasic code. One example had a delay subroutine that used a tight loop (a Windows and event-driven programming no-no) instead of the VB Timer control. Another example cross-referenced



source code listings by line numbers—not very useful in a visual, highly modular system like VB. On the plus side, the book includes several useful routines and forms on a floppy disk.

For me, the most impressive piece of work came directly from Microsoft Press in the form of *The Microsoft Visual Basic Workshop*. This book turns a moderately skilled programmer into a VB expert. It has a terse, no-nonsense style that lets it cover a lot of ground in a little space, and it's loaded with useful examples. The advanced topics are covered well, including examples of VB DLL client and server programs and interfacing to both Windows and custom DLLs. The floppy disk makes the package complete.

*Visual Basic by Example* and *The Microsoft Visual Basic Workshop*, combined with the documentation and on-line help included with VB, will put you on the fast track to creating your own Windows applications.

—Tom Yager

*Visual Basic for Windows Inside & Out*, Gary Cornell, Osborne/McGraw-Hill, \$27.95, ISBN 0-07-881764-1.

*Visual Basic by Example*, D. F. Scott, Que, \$21.95, ISBN 0-88022-904-7.

*Visual Basic Power Programming*, Namir C. Shammas, Windcrest, \$29.95, ISBN 0-8306-3963-2.

*The Microsoft Visual Basic Workshop*, Hohn Clark Craig, Microsoft Press, \$34.95, ISBN 1-55615-386-4.

## QUALITY BY DESIGN

*Turn Signals Are the Facial Expressions of Automobiles*, Donald Norman, Addison-Wesley, \$28.95, ISBN 0-201-58124-8.

**T**urn signals? Facial expressions? What do these have to do with computers? Nothing, at first glance.

On the other hand, this sequel to *The Design of Everyday Things* continues Donald Norman's crusade to make the world around us more suitable. He is a champion of the appropriate uses of technology and design.

This book immediately struck a responsive chord. Ever attend a school play? Ever become frustrated with all those clicking, whirring, beeping, and whining cameras? I managed to encounter this just before discovering that Donald Norman's opening chapter is a recounting of just such an experience. This is technological rudeness, a benign technology transformed into an unstoppable annoyance, leading you to lose the enjoyment, the fun, the wonder of the moment.

When design breaks down, signs show up. Signs mean something is wrong—the task to be completed is either too complicated or inappropriately designed. The example of a door with a large, flat push handle and the accompanying "Pull" sign is exquisite. Everyone has experienced this beast. Everyone wonders why the silly door doesn't open the way it "should." (And some of us continue to push, even after seeing the sign.) When the real world does not match our internal-world model, we need time to adjust. The world would be much simpler if the model were consistent.

The messages are clear and thought-provoking: Be consistent, be appropriate, don't intrude, be polite.

—Raymond GA Côté

## CORPORATE SNAPSHOTS



**C**orporate Snapshots, Disclosure's \$995 annual CD-ROM release, contains key facts and figures for over 11,000 public companies. Disclosure (5161 River Rd., Bethesda, MD 20816, (301) 951-1427) culls data directly from original SEC filings and other public sources. The financial information provided includes a few key ratios, but it isn't as complete as the information you'll find in an annual report. You won't find a breakdown of assets and liabilities, for example, nor a detailed balance sheet. Corporate Snapshots functions mainly as a directory of corporate America.

Each record contains general information, such as company name, address, telephone number, SIC (Standard Industrial Classification) codes, and a description of the markets the company pursues. It also lists shareholder information: current outstanding shares, shares held by officers and directors, and the total number of shareholders.

Financial overviews include a five-year summary of sales, net income, and earnings per share, with two years' worth of selected financials (i.e., total assets, shareholder equity, net sales, net income, total liabilities, and net worth) and seven financial ratios (e.g., quick ratio, current ratio, net sales/assets, debt/equity, and net income/net sales). Do you want to know what your local CEO is raking in? You can find that here, too, along with the salaries of other corporate officers.

A simple, effective menu interface makes the data accessible. You open the database from the main menu and can search by almost any data field. Once you've selected a record, you can display the entire record or just a subset (e.g., the annual financials or list of directors). You can also create your own format for displaying records, sending records to a printer or file, and generating mailing labels.

You can locate records by company name, type of business, geographic area, officers and directors, or Fortune 500 ranking. Once you've derived a subset of data with a search operation, you narrow or broaden the search by adding new concepts or terms. Searching and sorting comparators let you, for example, list companies by total sales or select only companies with a net income between \$100 million and \$200 million. You can search text fields, such as business descriptions or subsidiary names, for specific words or phrases or do proximity searches.

You can export selected records for use in a spreadsheet. You won't find enough financial data here to make informed investment decisions, nor does Corporate Snapshots offer investment guidelines. (For investors, Disclosure offers Compact D/SEC, a monthly subscription service on CD-ROM, with detailed financial information on 12,000 public companies). As a resource for quick facts, Corporate Snapshots works well.

—Stanford Diehl



# Redefining RAID to a gRAIDER rate

## CONCEPT

RAID is an advanced storage technique designed to efficiently secure on-line information.

The RAID concept is designed to speed up access to files by performing multiple, independent transactions simultaneously.

RAIDER embodies DynaTek's mission to optimize security and to maximize speed and capacity.

## ENGINEERING

RAIDER engineering is the product of the accumulated knowledge of a brilliant team that implemented disc striping, mirroring and RAID levels 3 and 5 in the most practical way; a team which is dedicated to benchmark your required implementation and to optimize it for your application.

It is highly innovative engineering which goes beyond the conventional levels of RAID to the extended redundancy levels of RAIDER.

## CONSTRUCTION

RAIDER construction is an ingenious, creative design of superior craftsmanship, manufactured in a quality-controlled production environment.

It is a ruggedized, flexible, but compact electronically redundant disk array.

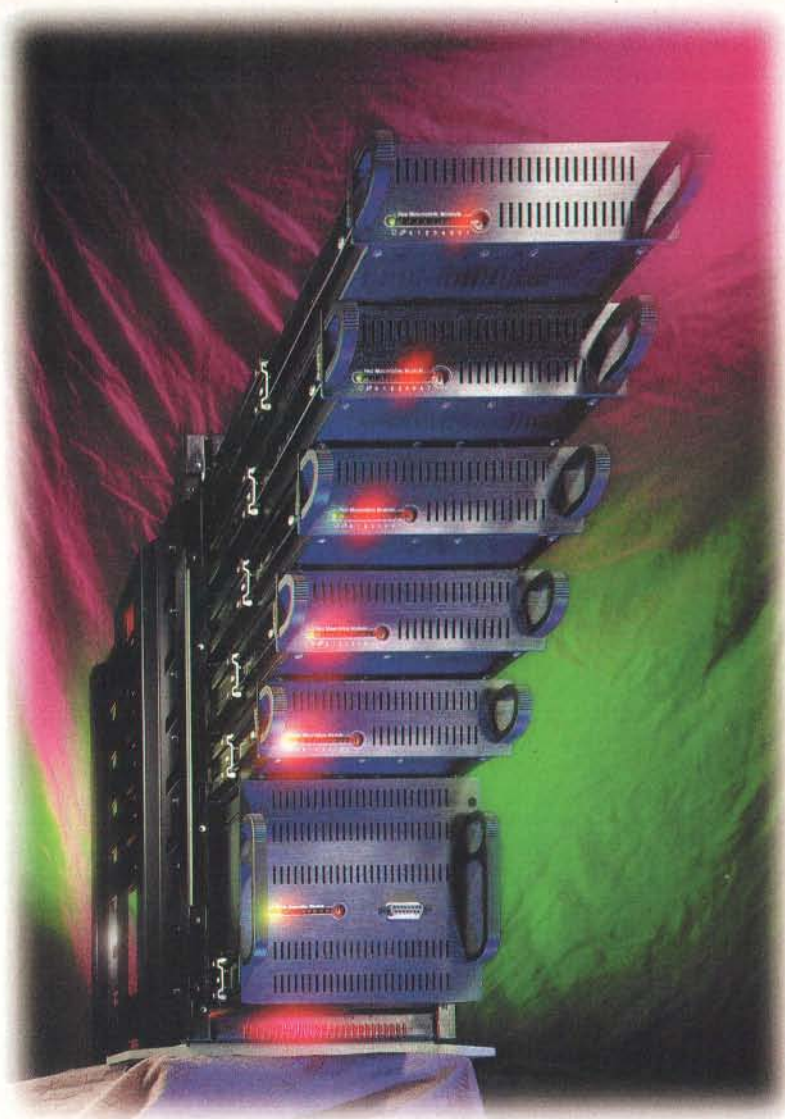
RAIDER is designed to complement the security obtained through disk redundancy by utilizing self-contained, "hot-mountable" modules.

It is built to maximize RAID to a gRAIDER level.

## INTEGRATION

RAIDER integration is accomplished using Management Interface for Raider (MIR), allowing RAID administration on operating systems across different platforms.

Whether Novell or OS/2, UNIX V5.4 or AIX – MIR expands RAID to a gRAIDER range.

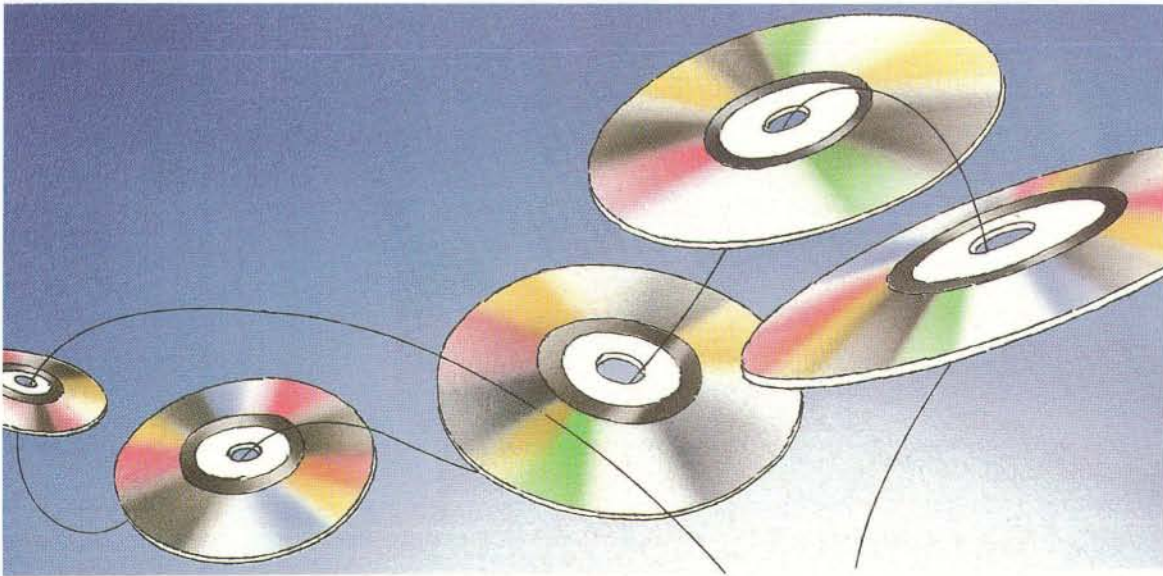


**RAIDER**  
*The Future of Storage*





# DISK ARRAYS EXPLAINED



**T**raditional I/O subsystems can't keep up with today's microprocessors. As 486s and 586s push the clock rates of PCs to 66 MHz and fast 68040s accelerate high-end Macs, hard disk subsystems bottleneck severely. Since the IBM XT first appeared on the market with its then-vast internal 10-MB hard disk, processor performance has increased five or more times faster than that of hard disks—and the disparity continues to widen.

As computers grow in power and as the demands on LANs increase, the storage crunch worsens. Bigger single disk drives were the first line of defense. But 3½-inch drives are now reaching capacities of 1 GB, and 5¼-inch drives exceed 3 GB. But many users need even more space, particularly those downsizing from large and midrange computers to LANs.

A disk array, which groups multiple drives into what appears to be a single logical volume, can narrow the performance gap between processors and hard disks by working the component drives in parallel. A disk array also substantially boosts total subsystem capacity. The mission-critical nature of LANs highlights another key benefit of disk arrays: reliability. Disk drives are inherently the most failure-prone component of a computer system. Tape backup is a common minimum level of protection against drive failure, but many companies are willing to pay a premium to avoid costly—if not catastrophic—system downtime.

In disk array terminology, the terms *data availability*

and *fault tolerance* are used instead of *reliability*. Putting multiple drives together in an array is actually less reliable than using an individual drive, since there's an increased chance that one of the drives will fail sooner than others. But data redundancy enables many disk arrays to tolerate the failure of one drive.

## **Harnessing gangs of hard disks boosts capacity, performance, and reliability**

### **Fundamental Concepts**

The seminal work on modern disk array architectures appeared in a late-1987 paper by Patterson, Gibson, and Katz of the University of California–Berkeley. Entitled “A Case for Redundant Arrays of Inexpensive Disks (RAID),” the paper compared RAID to its alternative, the SLED (single large expensive disk), and established five competing RAID levels, or architectures, each with its own unique combination of trade-offs. Disk arrays generally increase performance by sustaining multiple simultaneous read and/or write operations. How effectively a disk array increases performance depends on the RAID architecture used and how the manufacturer implements it.

The *host adapter* (i.e., system drive controller) that is used to control the drives in a disk array crucially affects performance and fault tolerance. While disk arrays are often implemented with a single host adapter, this



arrangement constitutes a single point of failure: If the host adapter fails, the entire disk subsystem is unusable. To circumvent this, two or more host adapters can be used in a disk array implementation, allowing continued operation of the disk subsystem in the event of a single controller's failure. There's another advantage: Multiple controllers provide additional data paths to the drives to increase the data transfer rate of the disk array.

SCSI host adapters (including the newer SCSI-2 adapters) are used almost exclusively in disk array designs because the intelligent SCSI connection lends itself well to this application. One particularly valuable feature of SCSI is its disconnect/reconnect capability. A host adapter can send a command to an individual drive (i.e., "write a sector" or "seek to a particular sector") and then disconnect from that drive before the command is completed in order to send a command to another drive for simultaneous execution. The host adapter then reconnects with each drive in turn as it completes its work. Some disk arrays use ESDI or IDE drives, but even these disk arrays typically use a SCSI host adapter that can control the array's ESDI

or IDE drives through appropriate secondary controllers.

Redundancy and the associated fault tolerance are key to the operation of nearly all modern disk arrays. The disk array driver software or intelligent host adapter must be able to detect a drive failure and notify the system operator while continuing to process disk reads and writes.

To eliminate downtime, many disk array implementations allow "hot swapping" of failed drives. A failed drive can be replaced with a new drive while the power is on and the system is operating normally. The disk array driver software then rebuilds the appropriate data onto the new drive as a background task while the system continues to operate normally—albeit with a noticeable performance decrease. With some array drivers, you can specify the amount of system processing time to be dedicated to the rebuild: You can choose a fast rebuild with a substantial performance penalty or a slower rebuild that is less taxing on the system.

### How Disk Arrays Work

Most disk arrays use some form of *striping*, or distribution of data across multi-

ple drives. Striping may occur on a bit level or on a sector (i.e., block) level. Bit-level striping typically occurs in multiples of 8 bits to and from each drive. The first chunk of data is stored on the first drive, the second chunk on the second drive, and so on for all the drives. For example, each drive in a four-drive array may have an 8-bit SCSI connection capable of a 2-MBps data transfer rate. By byte-striping the data across the four drives in 32-bit (i.e., 4-byte) chunks, 1 byte to each drive, the effective data transfer rate becomes 8 MBps for both write and read operations.

A disk array that implements striping without any drive redundancy is often referred to as RAID 0, although it is not a true RAID implementation as defined in the Berkeley paper. Since such a disk array offers no fault tolerance, it is less reliable than a single-drive implementation; its only virtue is speed. Such a disk array would be suitable only for certain special applications—perhaps in scientific analysis or imaging—that can tolerate compromised system reliability.

The use of *mirroring* for fault tolerance in microcomputer networks is now well established and was in use even before it

## DATA COMPRESSION LIBRARIES™

PKWARE's® Data Compression Libraries™ allow software developers to add data compression technology to software applications. The application program controls all the input and output of data allowing data to be compressed or extracted to or from any device or area of memory.

- All Purpose Data Compression Algorithm Compresses Ascii or Binary Data Quickly with similar compression achieved by the popular **PKZIP** software, however the format used by the compression routine is completely generic and not specific to the PKZIP file format.
- Application Controlled I/O and memory allocation for extreme flexibility.
- Adjustable Dictionary Size allows software to be fine tuned for Maximum Size or Speed.
- Approximately 35K memory needed for Compression, 12K memory needed for Extraction.
- Compatible with most popular Languages: C, C++, Pascal, Assembly, Basic, Clipper, Etc.
- Works with any 80x86 family CPU in real or protected mode. \$295.00
- No runtime royalties.

### RUNNING OUT OF EXPENSIVE DISK SPACE?

**PKZIP** can help! **PKZIP** compresses your files to free up disk space and reduce modem transfer time. You can compress a single file or entire directory structures with a single command. Compressed files can be quickly returned to their normal size with **PKUNZIP**.

Software developers can reduce the number of diskettes needed to distribute their product by using **PKZIP**. Call for Distribution License information.

The included **PKZIP** utility lets you store compressed files as a single self-extracting .EXE files that automatically uncompresses when run. Only \$47.00



9025 N. Deerwood Dr.  
Brown Deer, WI 53223  
(414) 354-8699  
Fax (414) 354-8559

BY1092



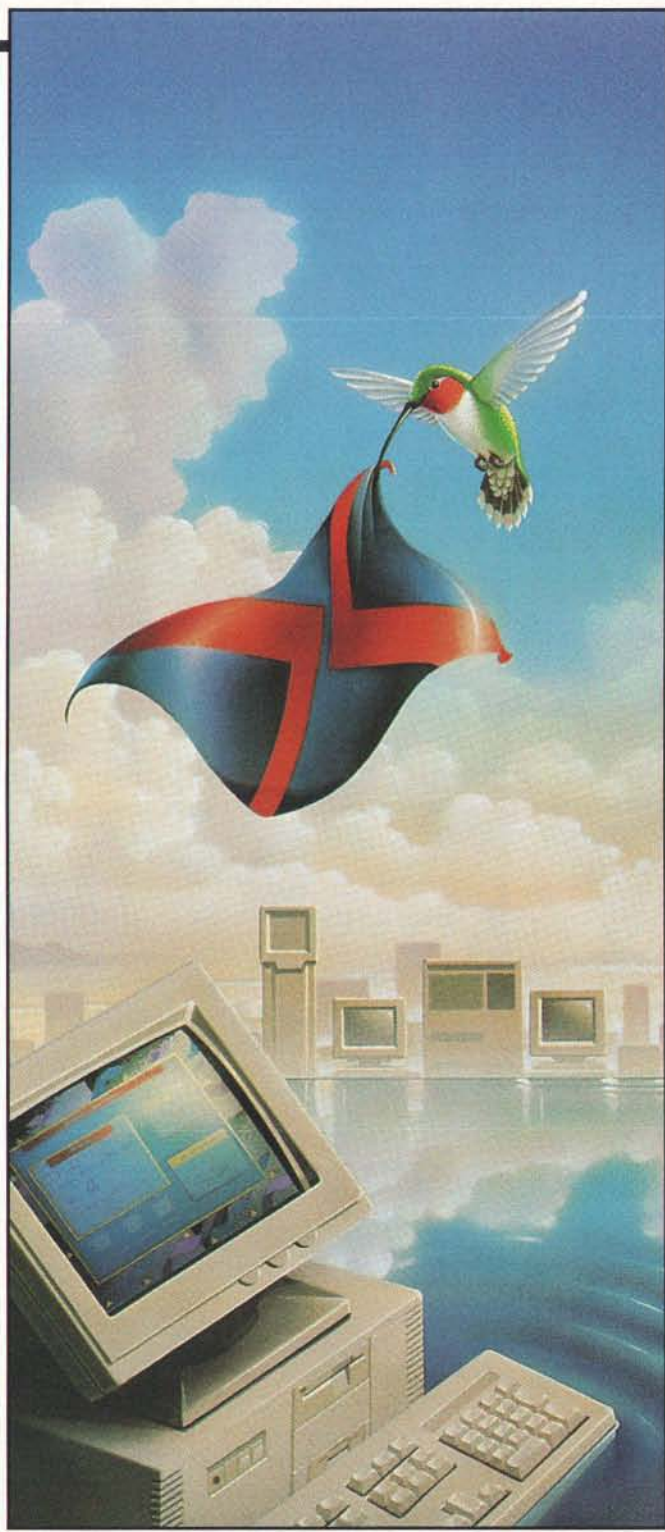
# EXCEED THE LIMITS OF X TERMINAL EMULATION.

Turn your PC into an X station.

With HCL-eXceed/W X server software, Hummingbird allows you to live in two worlds: MS/MS-Windows and Windows/UNIX. Imagine being able to see both text and images between UNIX hosts and your PC. It's as simple as copying and pasting from one window of your PC screen to another.



Discover other innovative capabilities of HCL-eXceed/W. Launch Pad menuing facility. Inet and FTP applications. 1 R5: support for scalable fonts, font servers, DMCP security. Start — X client program.arter. Trace — protocol tracing facility. Single window and multiple window mode. Supports 15 different TCP/IP transports and DECnet



- supports up to 16 million colors
- plane mask support

## X Development Tools

HCL-eXceed/W now includes the Xlib, Xt intrinsics, Xaw and Xmu libraries. This introduces a whole new dimension to PC X servers. Now you can use your PC as a low-cost workstation to develop and run X applications. You can also give other PCs and workstations access to these applications over the network.

HCL-eXceed/W from Hummingbird. It's far more than X terminal emulation for PCs. And it's one of the family:

**HCL-eXceed Plus** — A DOS-based X server with a local window manager that supports EGA, VGA and Super VGA.

**HCL-eXceed HiRes** — The same as "Plus" but it also supports 8514A, XGA and TIGA 2 high resolution graphic standards.

**HCL-eXtend** — UNIX host-based X clients for accessing DOS services.

For the name of your closest reseller, please contact:

2900 John Street, Unit 4, Markham, Ontario, Canada L3R 5G3

Telephone: (416) 470-1203, Fax: (416) 470-1207

In Europe: 37-39 rue de Vermont, 1202 Geneva, Switzerland

Telephone: 41 (22) 733 18 58, Fax: 41 (22) 734 14 79

Circle 111 on Inquiry Card.



**HUMMINGBIRD  
COMMUNICATIONS LTD.**



received its RAID 1 designation. Novell NetWare, in particular, incorporates support for disk mirroring. With mirroring, two drives store identical information so that one is a "mirror" of the other. Thus, for every disk write operation, the system must write to both disks. In the event of a disk failure, the other drive keeps working until the failed unit is replaced, with no lost data and no system downtime.

Since dual-write operations can actually degrade system performance, many im-

plementations employ *duplexing*, where each mirrored drive has its own host adapter. The dual-adapter approach allows read and write operations to take place in parallel, enhancing the performance of the disk subsystem. The redundant host adapters also beef up system fault tolerance, since disk operation will continue even if one of the adapters fails.

Duplexing is often further enhanced by incorporating striping, which creates a RAID 0/1 disk array. Several drives at-

tached to one host adapter are striped, while the same number of drives attached to a second host adapter are also striped in a fashion that mirrors that of the drives on the first host adapter. While the mirrored/duplexed disk array approach provides good fault tolerance, it is relatively expensive to implement, because only half the available disk space can be used for data storage.

## Less Expensive Redundancy

There's something inherently distasteful about having 5 GB of on-line disk storage but only being able to use 2.5 GB of it for data storage because the remainder is used for data redundancy. Other RAID architectures were therefore developed to improve both performance and storage efficiency while retaining an acceptable level of data availability.

RAID 2 is one approach that has succeeded in improving the reduction of data storage overhead. It uses extra check disks, with data bit-striped across the data and check disks. The data includes an interleaved Hamming code, which can be used to detect and correct single-bit errors as well as detect double-bit errors. Because of the amount of information required for the check bits, several check disks are required to implement RAID 2. In an array with 10 data disks, for example, four check disks would be required, resulting in about 71 percent of the disk storage space being available for actual data storage. An array with fewer than 10 data disks becomes impractical, because the amount of storage available for data drops off quickly and can drop well below 50 percent.

Because of its interleaved Hamming code, RAID 2 is relatively complex to implement. It's optimal for reading and writing large data blocks at high data transfer rates, but smaller block reads are inefficient, and the read-modify-write operations required for small block-write operations result in poor performance. While mainframe RAID 2 implementations have been developed, RAID 2 is generally impractical for smaller systems.

The RAID 3 approach is now used widely in workstations and is seeing increased use in microcomputer LANs. However, standard microcomputer drives already incorporate ECCs (error-correction codes) with every sector written to every disk; thus, the RAID 2 bit-level approach to data recovery is unnecessarily redundant. Only enough redundant information to recover data from the failed drive, should any single drive fail, needs to be stored in the disk array.

RAID 3 uses a single redundant check disk (sometimes called a *parity disk*) for



## HOW TO EXTEND YOUR CAD POWER

With Generic CADD, you can put the power and productivity of CAD on every desk. From engineering to manufacturing to tooling and more, Generic CADD allows you to view, edit, export and print your valuable AutoCAD\* designs, or sketch design concepts. Generic CADD software runs on standard PCs, Macs, and laptops, utilizing existing hardware. At \$495, it's the economical way to extend your CAD power. To learn why over 300,000 people are using Generic CADD, call 1-800-228-3601.

Ask for Info Pak #A30.



\*Generic CADD 6.0 and Generic CADD for Macintosh 2.0 — load native AutoCAD/DWG drawing files directly. Copyright 1992 Autodesk Retail Products. All rights reserved. Generic CADD is a registered trademark of Autodesk Retail Products. AutoCAD, Autodesk, and the Autodesk logo are registered in the U.S. Patent and Trademark Office by Autodesk, Inc. Macintosh is a registered trademark of Apple.





# Your Direct

**BYTE introduces Your Direct Link – An enhanced service for BYTE readers that gives you free information on products – faster and easier!**

In the NEW Direct Link section, here's what you'll find:

**Alphabetical Index to Advertisers Including Phone Numbers**

Now dial companies directly.



**Product Category Index to Advertisers**

Order information on individual products or complete product categories.

**Redesigned Editorial Index**

Free information from companies covered in articles, columns, or news stories.

**New Enhanced Direct Link Card**

Receive free information quickly by filling out and mailing or faxing *Your Direct Link Card* today!



Send for **FREE** product information by filling out *Your Direct Link Card* found in the back of every issue.

**Buy It Through BYTE!**

**BYTE** 

**Link to Products**



each group of drives. A computer may have multiple drive groups to further enhance capacity, performance, or fault tolerance. Data written to the RAID 3 disk array is bit-stripped across the data disks. The check disk receives the XOR (exclusive-OR) of all the data values written to the data drives. Since data transfers to and from individual drives occur only in unit-sector multiples, the minimum amount of data that can be written to or read from a RAID 3 disk array is the number of data drives multiplied by the number of bytes per sector; this is known as a *transfer unit*. A typical five-drive array, for example, would have four data disks and one check disk and might have a 512-byte sector size on each disk. The transfer unit in this case is 2048 bytes ( $4 \times 512$ ).

Since the multiple drives in the disk array are written or read simultaneously, extremely fast data transfer rates can be achieved. This is particularly true when the size of the data being written or read is at least the size of the transfer unit. The performance of a RAID 3 implementation slows down considerably when many smaller data transfers are taking place, such as might occur in a transaction-pro-

cessing application. For data reads smaller than the transfer unit, all the data in an entire transfer unit must be read anyway. This makes the read operation longer than would otherwise be necessary, thereby reducing the efficiency of the operation.

Write penalties are worse. For data writes that are smaller than a transfer unit, only a portion of a sector of each data disk needs to be modified. But, again, the disk array must deal with complete transfer units. In this case, a complete transfer unit must be read from the combined data disks; then, the new write data must modify the read data where appropriate; finally, the modified read data must be written back to the data disks, with the check disk being updated appropriately.

This arrangement clearly results in slower write operations when small amounts of data are being written. Because of this, RAID 3 implementations are preferable for applications that process large chunks of data.

Rotational latency—the time it takes a drive's platters to rotate to the position where the sector being accessed is under the drive's read/write heads—can vary among the various disks in an array, re-

sulting in added delays during data transfer operations. To alleviate this problem, most RAID 3 implementations incorporate spindle synchronization to keep the rotation of all drives in a group synchronized for maximum performance.

The clear advantage of the RAID 3 approach over RAID 0/1 is the reduced overhead for the redundant check disk. In a five-drive array, for example, four of the five drives, or 80 percent, are used for data storage. This provides 4 GB of data storage in a 5-GB disk array.

## Better Transaction Processing

RAID 4 offers a disk array architecture that's better optimized for transaction-processing applications than RAID 3's architecture. One notable difference between RAID 3 and RAID 4 is that the latter performs block striping or sector striping on the data on the drives, while the former performs bit striping. Thus, with RAID 4, one entire sector is written to one drive, the next sector is written to the next drive, and so on. This technique allows multiple unrelated sectors to be read simultaneously, and it is particularly valuable for small reads that need to access

## WINSLEUTH GOLD™

### SUSPECT, DETECT AND CORRECT!!!™

## WINSLEUTH™ GOLD

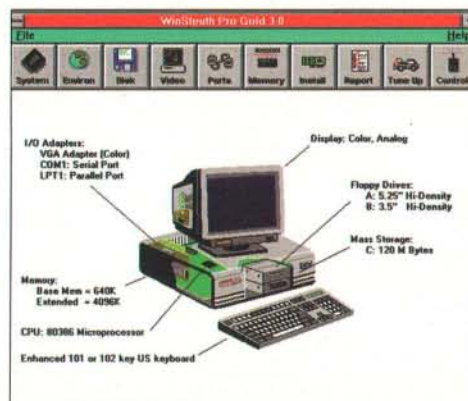
WinSleuth Gold is the first tutorial/analysis/diagnostic program specifically written to operate under Windows 3.0/3.1. A newly enhanced graphical user interface makes WinSleuth Gold the easiest WinSleuth to use, EVER.

Novice and advanced users will appreciate WinSleuth Gold's access to low-level information and functions. WinSleuth Gold can actually test and evaluate memory chips, serial and parallel ports, the video adapter and other vital system components. New users will find the on-line help facility valuable as a learning aid. WinSleuth Gold helps make complex aspects of computing such as IRQs, hard disk drives and video easier to understand.

TuneUp is now more comprehensive in its analysis and not only can make performance-enhancing suggestions, but with a set of NEW 'smart editors', can make changes to system settings automatically that improve Windows operation! Installation Assistant is a partner in the frustrating task of installing new hardware. With Report Generator send hardcopy to the printer, or an ASCII file for import into your database manager.

PC Computing, July, 1992 – BEST VALUE – "WinSleuth...is a godsend to Windows users intent on fine-tuning their systems." "WinSleuth...is exceptionally easy to use." – Preston Gralla

Questions? Call:  
714-236-1385  
**DARIANA, INC.**



BYTE Magazine, March, 1992 – First Impressions, "WinSleuth...is one of the few programs that I consider absolutely and positively necessary on my PC. One...should be on yours, too." – Stan Miskowski

LIMITED TIME OFFER!  
Order NOW!  
Get CO/Session--  
remote control program

MSRP  
WinSleuth (\$169.00)  
AND  
CO/Session (\$179.00)



ONLY  
**\$99!**

**COMPUCLASSICS**  
YOUR SOURCE FOR SOFTWARE

**800-827-1994/818-347-7500/FAX 818-347-997**



only a single drive in the array.

Like RAID 3, RAID 4 dedicates one entire disk for storing check data, allowing data from a failed drive to be easily recovered. While this approach allows multiple reads to occur simultaneously—different sectors from different drives—write operations are a bottleneck. Since the single check disk must be written to during every write operation, only one write operation can take place at a time.

RAID 5 overcomes RAID 4's single-write bottleneck, and it is becoming the dominant disk array architecture for microcomputer LANs and systems that go beyond the ubiquitous but inefficient mirroring approach. Unlike RAID 4, which dedicates a single physical disk for check data, RAID 5 dedicates the equivalent of one entire disk for storing check data but distributes the check data over all the drives in the group. For example, sector 1 of disk 5 may be assigned to hold the check data for sector 1 of the remaining data drives, while sector 2 of disk 4 may hold the check data for sector 2 of the remaining data drives, and so on.

Because the check data is simply the XOR of all the write-data values for the corresponding sector on each of the data disks, the new check data for a single-sector write can be calculated without having to read the corresponding sectors from the other data disks as long as the old sector data and the old check-data values are known. Thus, only two disks are involved in a single-sector write operation: the target data disk and the corresponding disk that holds the check data for that sector. This is in contrast to the RAID 3 implementation, which requires all drives in a group to be read and written when a single-sector-size write occurs.

The primary benefit of the RAID 5 distributed check-data approach is that it permits multiple write operations to take place simultaneously. It also allows multiple reads to take place simultaneously and is efficient in handling small amounts of information.

## Recovering and Rebuilding

The figure illustrates how data recovery works in RAID 3, RAID 4, and RAID 5 disk array designs. When data is written to multiple data disks, the XOR of all the data values is written to the check disk. If any one disk fails, the missing data from that disk can be determined (i.e., recovered) by taking the XOR of the data values from the remaining data drives and the check disk. This is a simple operation that can be implemented in either the system software or the host adapter.

When a failed drive—whether it's a

data or check disk—is replaced, the data on the replaced drive must be rebuilt so that it contains all the information from the original drive. Until the replaced disk is completely rebuilt, the disk array is vulnerable to another drive failure, which would be catastrophic. Once rebuilding is complete, however, the disk array returns to a fault-tolerant state, allowing any single disk to fail without disrupting system operation.

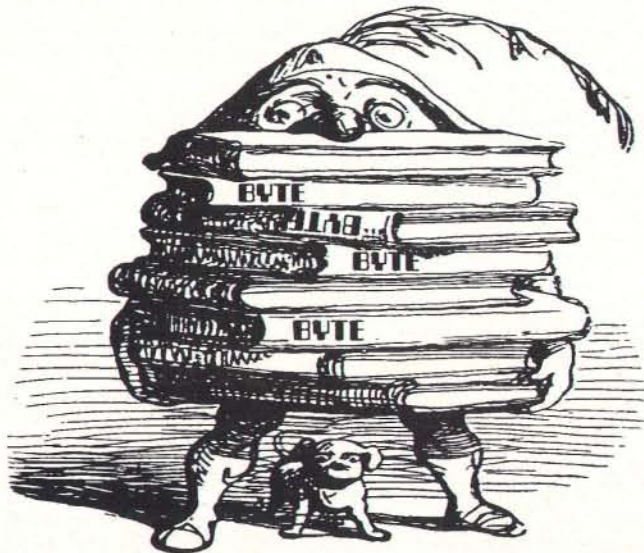
The operating system's disk array driv-

er is responsible for overseeing the rebuilding of a replaced drive. Interleaved with normal system activity, the data from the good drives in the array must be systematically read by the driver, which must then recover the missing data (using the XOR procedure described above) and store the recovered data on the replacement drive. Since the server system's CPU and disk resources are used for this process, a system performance degradation results until the rebuilding process is complete.

*continued*

## Subscription Problems?

We want to help!



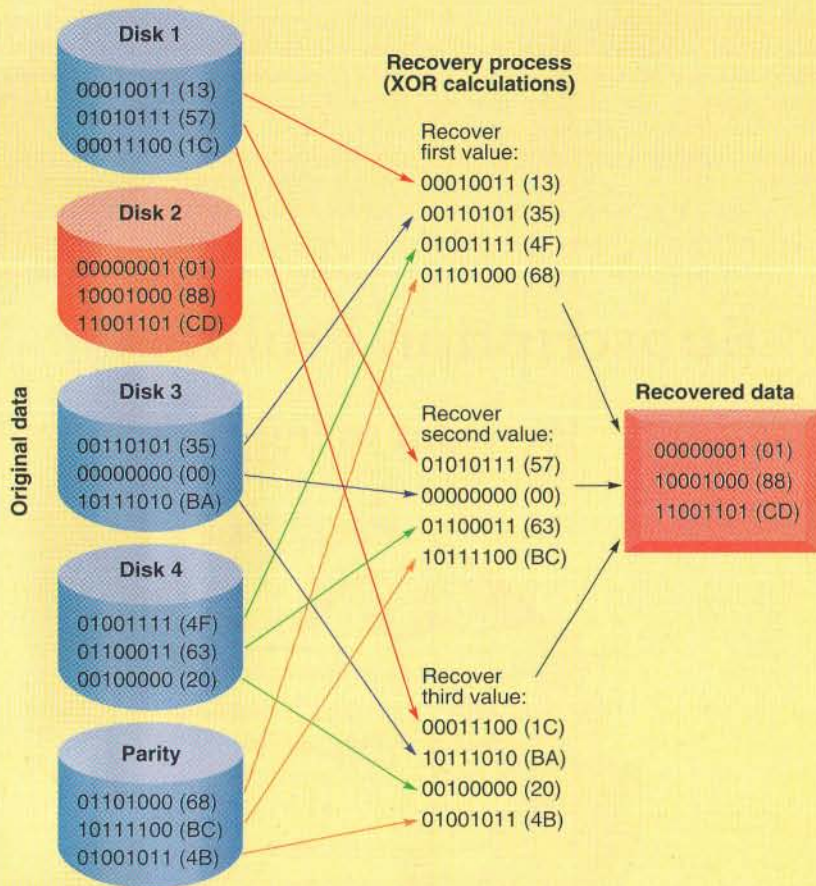
**If** you have a problem with your BYTE subscription, write us with the details. We'll do our best to set it right. But we must have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible.

## BYTE Magazine

Attn. Subscriber Service, P.O. Box 555  
Hightstown, NJ 08520



## DATA RECOVERY IN A RAID SYSTEM



In this example, disk 2 (shaded in red) has failed. The system recovers the data one value at a time. To recover the first value, the system reads the first value from each of the remaining disks and calculates an XOR on them, producing the first lost data value from disk 2. The process then repeats until the system has recovered all values. The process is the same for RAID 3, 4, or 5.

### Real-World Disk Arrays

Disk array implementations, while generally based on the designs described here, vary considerably among manufacturers. Some companies combine features of different array architectures to create a hybrid. Others take the concept of redundancy beyond the drive, incorporating redundant controllers and/or power supplies (see "No More Data Loss: The BYTE Lab Tests Six Disk-Array Subsystems," August BYTE).

Compaq was an early supplier of microcomputer disk arrays with its Systempro. This is essentially a RAID 4 implementation that gives you the ability to add a second controller that mirrors/duplexes two RAID 4 groups. Dell supplies its Dell Drive Array, another RAID 4 implementation, but it lacks hot-swap capabilities.

Despite these offerings, the general industry trend in disk arrays heavily favors RAID 5 over RAID 4. Since the same hardware can generally be used for either architecture, the primary difference is in the more complex software drivers required to implement RAID 5. It seems likely that existing RAID 4 implementations will eventually move up to the higher performance offered by RAID 5.

Another example of a modern disk array implementation is Legacy Storage Systems' Mass HFD NetSpan disk array for NetWare systems, which offers duplexed RAID 0/1 functionality with redundant SCSI controllers and redundant power supplies, one for each of the duplexed channels. The system, which can also operate as a RAID 5 disk array using optional software, features hot-swappable drives and

auto-sensing power supplies. If one supply senses that the other has failed, it provides power for both channels instead of just its own. Core International's CPR-400 disk array is a RAID 3 implementation that can operate with NetWare systems. It incorporates redundant controllers and power supplies and allows hot-swapping of failed drives, power supplies, and controllers.

Some companies, such as Chantal Systems and Integra Technologies, offer software-only RAID 5 solutions that support hot-swapping of failed drives and on-the-fly data rebuilding when a new drive is installed. Others offer specialized controllers that off-load some of the data-manipulation duties (e.g., check-data calculation) from the LAN processor to reduce system overhead and increase performance, such as Ciprico's RimFire 6600/10 series. NCR also has developed a special drive controller for optimizing disk array operations, and it now offers a disk array that can accommodate a combination of array architectures simultaneously, including RAID 0/1, RAID 3, and RAID 5.

In the Unix workstation arena, Storage Concepts offers SCSI-based RAID 3 disk arrays designed to operate optimally with the specific I/O structures used in Unix and Unix-like operating systems, which do not readily accommodate the concurrent-I/O operations of RAID 5.

Beyond simple mirroring, disk arrays are establishing themselves as a reliable, fast, high-capacity, and economical way to implement disk subsystems for personal computer LANs. Mirroring and duplexing are still appropriate for smaller installations that require fault tolerance and modest disk capacity, but RAID 3 and RAID 5 disk arrays, with similar fault-tolerance and performance characteristics and better disk-space utilization, are proving their worth in larger installations. While users with mission-critical applications will make the move to disk arrays out of necessity, many with less-critical applications will choose disk arrays because the increased performance and data availability make good economic sense for their companies. ■

### ACKNOWLEDGMENTS

I'd like to thank Frank Bellucci of Chantal Systems, Bill Moren of Ciprico, Mike Riley of Legacy Storage Systems, and Christopher Romine of Storage Concepts for their valuable contributions to this article.

Roger C. Alford, a BYTE consulting editor, is president of Programmable Designs, a Michigan-based consulting firm specializing in electronics design. He can be contacted on BIX as "rogera."

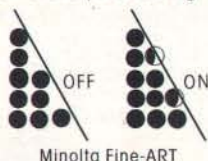


This printer knows how precious your time is.



## New from Minolta: Laser Printer SP3500.

See for yourself how the new Laser Printers SP3500 and SP3000 can be real time-savers in your business. Thanks to powerful RISC technology (AMD's 29K<sup>®</sup><sup>1</sup> family) they feature extremely fast data-processing speed, giving the least possible delay between data transfer and printing. You get 10 pages per minute in a superb print quality. The unbeatable combination of Minolta Fine-ART (Advanced Resolution Technology), the brilliant Micro-Toning System, Truimage<sup>™</sup><sup>2</sup> software (standard for SP3500 and optional for SP3000), Font Flexibility and Multi-Emulation. So ... don't waste a second making up your mind.



**Fax • Copiers • Laser Printers**

**Minolta. The simplicity of intelligence.**



Minolta GmbH • B.E.O. • In den Kolkwiesen 68 • D-3012 Langenhagen 1 • Tel. (05 11) 77 00-0

<sup>1</sup> 29K<sup>®</sup> is registered trade mark of Advanced Micro Devices, Inc. <sup>2</sup> Truimage<sup>™</sup> is trade mark of Microsoft<sup>®</sup> Corp.



# 386 SL NOTE BOOK

TP SUPERLITE



A - Dual Port Lan Adapter (TP-2000)  
B - Pocket Fax/Modem (TP96/24 V.42bis)

## EASILY CARRY ME ONLY 4.8lbs WITH IC CARD SLOT

### The 3rd generation Notebook-TP Superlite 386SL Notebook

Its light weight (4.8lbs-including HD, FD, IC Card & battery) and compact size (275x215x44mm) built the new record of Notebook.

#### Expansion capability

1 serial, 1 parallel, PS/2 mouse port, external VGA monitor ports and optional Fax/Modem make it easy for the expandability of the Notebook.

#### Expand the power with an IC Card

Can install I/O device (like modem, fax/modem, Lan, etc...) or expand system memory easily via available IC card slot (68-pin PCMCIA release 2.0, JEIDA Ver. 4.0 standard)

TP's Dual Port Lan Adapter (built-in BNC & RJ-45 connectors) - picture A and Pocket Fax/modem (9600bps/2400bps w/MNP-5 & V.42bis) - picture B, they are the best companies of your portable PC, working with you anywhere and anytime.

#### Designed for comfort of typing

Place the TP SUPERLITE's keyboard at the same incline as a standard desktop keyboard, typing will be more comfortable.

#### No longer wait for Windows

Using Sharp fast reponse time LCD display (32 gray scales), run perfectly under Windows 3.1.



**TECHPOWER CO., LTD.**

20th Fl., No. 204, Sec. 5, Mingsheng E. Rd., Taipei, Taiwan, R.O.C.  
Tel: (02) 753-1930 Fax: 886-2-7531940/7153105

All brand names are registered trademarks of their respective owners. The above information is subject to change without notice

## BYTE BACK ISSUES FOR SALE

1988 1989 1990 1991 1992

January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
Special Issues				Outlook '92	

Rates (postage and handling included):

Holland	Dfl 18.00	Switzerland	SwFr 14.00
United Kingdom	£ 5.75	France	FFr 54.50
West Germany	DM 16.50	Sweden	SEK 58.00

Please indicate which issues you would like by checking (✓) the boxes. Send requests with payment to:

BYTE Back Issues, c/o Dynamic Graphics International, P.O. Box 25, 3950 AA Maarn, The Netherlands

☐ Check enclosed

Charge: ☐ MasterCard ☐ Eurocard ☐ VISA ☐ American Express

Card# \_\_\_\_\_

Exp. Date \_\_\_\_\_

Signature \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

All orders must be prepaid. Pay only in currencies given.

Please allow three weeks for delivery by surface mail.

☐ Issues Available



# THE COLOR OF POWER



## COLOR NOTEBOOK DCN386SL

### CPU

Equipped with the speedy 25MHz/80386SL, the latest Intel processor designed especially for notebook computers. Lots of built-in power saving features.

### BATTERY

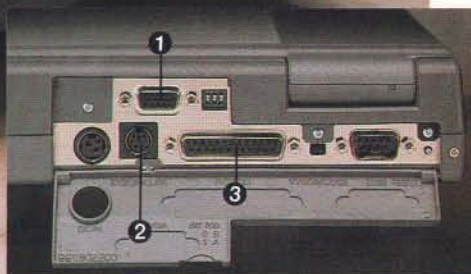
Long-life, 2.8 AH Ni-Cad minimal weight battery provides 3-4 hours of power with normal use. Easy to change, quick to recharge.

### KEYBOARD

Popular ergonomic design, available in European versions.

### BUILT-IN J-KEY MOUSE

Embedded in the keyboard, the J-key mouse is a clever alternative for an external tracker ball or mouse for maximum portability.



1- External PS/2 compatible keyboard & mouse connector.

2- External VGA color monitor connector (800 x 600).

3- Bi-directional enhanced parallel port/external FDD connector.

With locations in France and The Netherlands, Daewoo Telecom Europe serves the European market with an extensive line of notebooks, desktop and monitor products.

# DAEWOO

## Your Powerful Partner

Circle 415 on Inquiry Card.



Screen for using up to brilliant colors at the same time.

### SIZE

Measuring 28.4 x 22.1 x 5 cm, the thinnest color notebook available. Light weight (2.8 kg), ergonomic design in sophisticated metallic grey make this COLOR NOTEBOOK a pleasure to see, carry and to use with.

### VIDEO

Supports simultaneous video on both LCD and external monitor.

### HARD DISK

160 MB or 120 MB hard disk provides high capacity for safe storage.

### PORTS

Connection of up to 4 external devices through a single port.

### MODEM

Optional fax/modem for sending and receiving.

### POWER MANAGEMENT

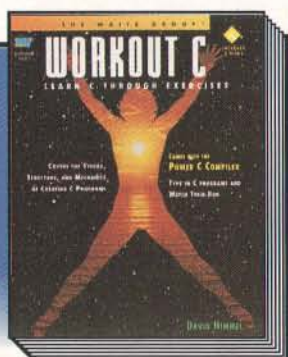
Ability to use suspend & resume allows you to save power without leaving the application for days. Auto power-up for waking and sending faxes and any time of day or night.



# Struggling With Microsoft® or Borland® C? Shape Up With Our Easy 3 Step Solution

For a Limited Time  
**\$49.95**  
(\$30.00 Off List Price!)

1



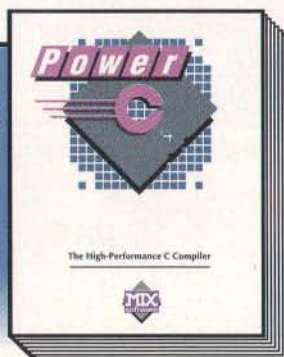
## START WITH THE WAITE GROUP'S NEW WORKOUT C.

This balanced training program covers all topics and concepts of C programming, from simple to complex. Throughout more than 800 pages of illuminating text, hundreds of hands-on exercises illustrate everything from arrays to unions and bit fields.

Workout C includes special versions of our Power C compiler and split-screen text editor, so you can compile and execute the example programs at the press of a key. There is no substitute for practice, and you get plenty of it with useful and interesting programs such as a calculator, card playing game, file dumping utility, and animated graphics.

By the time you finish Workout C, you'll have a very solid foundation on which to build a successful C programming career.

2



## AFTER PUMPING UP WITH WORKOUT C, YOU'LL BE READY TO DO SOME HEAVY DUTY PROGRAMMING WITH POWER C.

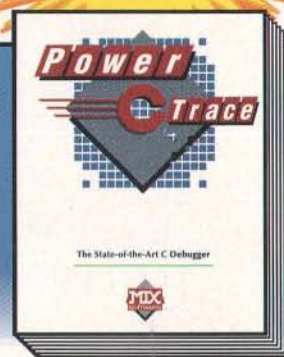
This ANSI standard C compiler is now used by over 100,000 programmers worldwide. PC magazine calls it "a heavy-weight contender at a bantam-weight price," and Power C is a three time winner of Computer Shopper's Best Buy award.

Even though it's powerful, Power C is very easy to use. That's why The Waite Group chose it over all other compilers for Workout C. And unlike some compilers that hog 30 or 40 megabytes of disk space, Power C requires only 1 megabyte.

### FEATURES INCLUDE:

- ☒ Over 450 Library Functions
- ☒ Small, Medium, & Large Models
- ☒ Mixed model with near/far/huge
- ☒ Supports 8088/286/386/486
- ☒ Supports 8087/287/387
- ☒ CGA, EGA, VGA, Hercules Graphics
- ☒ 650 page manual

3



## AS YOU DEVELOP YOUR OWN C APPLICATIONS, POWER CTRACE PLAYS A CRUCIAL ROLE IN THE PROCESS.

This state-of-the-art debugger helps find your programming errors fast. Describing Power Ctrace in a word, Computer Shopper simply calls it "magnificent."

No other debugger shows you the internal working of your program the way Power Ctrace does. Watch your C source code executing not just line by line, but statement by statement. While viewing source code in one window, simultaneously view variable values and program output in other windows. Break and watch points stop execution at suspected trouble spots.

Like Power C, Power Ctrace is very simple to use. Combined with Workout C, this trio of products will end your struggles and put you in great C programming shape.

## Order Now and Save \$30 Off List Price

☐ Please Send FREE Brochures  
Disk Size: ☐ 5.25" ☐ 3.5"  
(Requires DOS 2.0 or higher)

Name \_\_\_\_\_  
Company \_\_\_\_\_  
Street \_\_\_\_\_  
City \_\_\_\_\_  
State \_\_\_\_\_ Zip \_\_\_\_\_  
Country \_\_\_\_\_  
Telephone \_\_\_\_\_

☐ Workout Pack ..... **\$49.95**

Includes: ☒ Workout C  
☒ Power C  
☒ Power Ctrace

Shipping & Handling ..... \_\_\_\_\_

(\$5 USA, \$10 Canada, \$40 Foreign)

Sales Tax (Texas Only) ..... **\$4.53**

Total Amount of Order ..... \_\_\_\_\_

Paying By: ☐ Check or Money Order

☐ Visa ☐ MC ☐ Amex ☐ Discover

Card# \_\_\_\_\_

Exp. Date \_\_\_\_\_

B

## 60 DAY MONEY-BACK GUARANTEE

To Order Please Call:

**1-800-333-0330**

For Technical Questions:

Tel: 1-214-783-6001

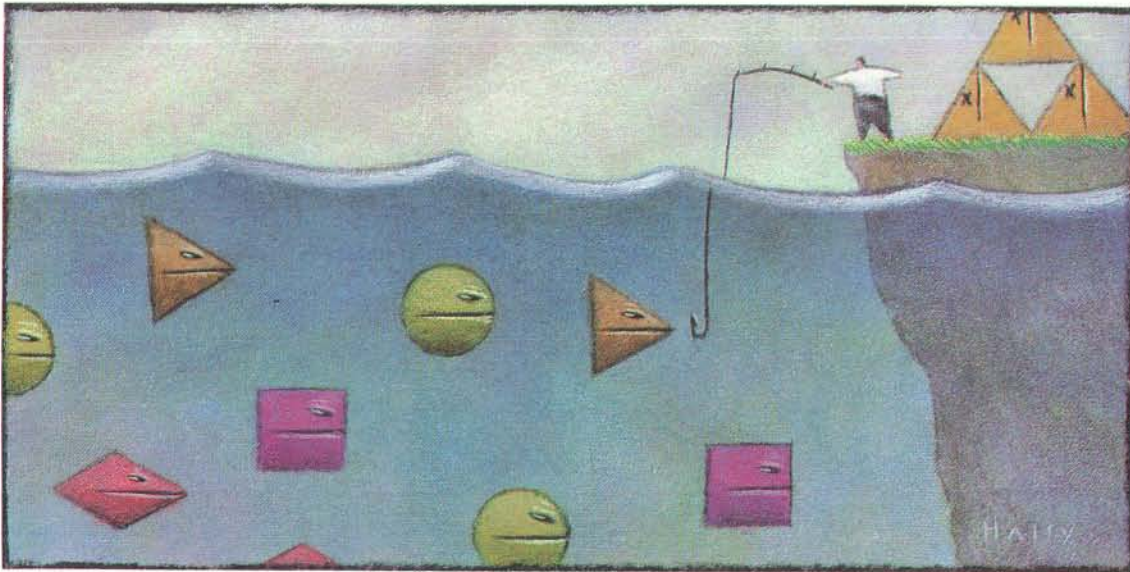
Fax: 1-214-783-1404



Mix Software  
1132 Commerce Dr.  
Richardson, TX  
75081



# MAC OOP EXPLAINED



**O**OP (object-oriented programming) has become increasingly popular over the past several years, and for good reason. Once you've overcome a few hurdles, this programming method can dramatically shorten the amount of time needed to construct an application, compared to traditional procedural programming. The reason is simple: With OOP, you create modular objects to build applications. Once you've created these objects, you can easily integrate them into subsequent applications.

You won't realize the benefits of OOP until you've created a series of classes. And it may take as long (if not longer) to construct the needed classes for your first OOP application as it would to construct standard procedural code. As you go on to develop further applications, however, you can reduce development time by using classes you developed in previous applications.

Object-compiler vendors help you get started by including *class libraries*—a group of classes structured to assist you in developing applications. Within those classes are the methods and instance variables that are required to perform actions such as controlling menus, drawing, handling mouse-clicks and key presses, printing, and saving files. Two popular class libraries for the Macintosh are MacApp for MPW and the Think Class Library for Think C.

To help you better understand how OOP programming works, I've built a sample program using the TCL. My program implements a tool palette similar to those

used in draw and paint programs. It has three buttons; an arrow tool, a text tool, and a rectangle tool. Each specifies a different cursor shape when it's selected. The arrow tool shows the arrow cursor, the text tool displays the I-beam cursor, and the rectangle tool shows the cross-hairs cursor. The rectangle button changes its icon whenever the user double-clicks on it. This feature might allow the user to choose an outline-only or filled-drawing mode for rectangles. Listing 1 includes code fragments from the tool palette program.

## Inheritance Issues

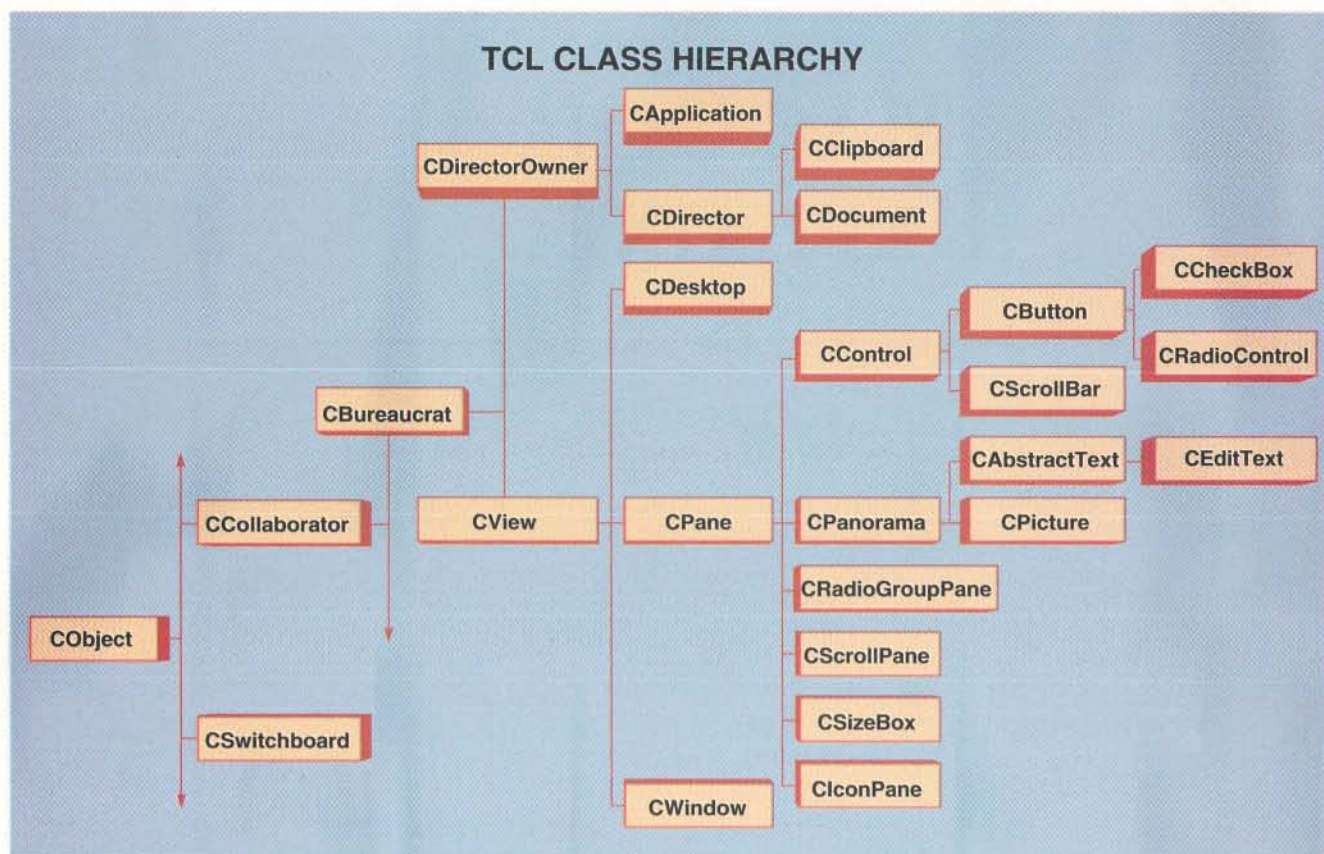
As a programmer, you're probably familiar with OOP's inheritance hierarchy of classes. Figure 1 shows a portion of the TCL inheritance hierarchy, or *class hierarchy*.

The class hierarchy defines the library classes as they relate to object-oriented concepts. This is the structure that defines the inheritance path, the instance variables, and the methods of each class. The relationships between the classes in this structure are based solely on subclasses and superclasses.

Many classes in libraries are abstract. You use them not to create objects directly, but to provide methods and instance variables that subclasses inherit. In the sample program, I created subclasses for the abstract TCL

**Object-oriented programming can cut your development time on the Mac**





**Figure 1:** A portion of the TCL class hierarchy. This structure defines the inheritance path, the instance variables, and the methods for each class.

classes CApplication, CDocument, and CPane. I call these subclasses CDemoApp, CDemoDoc, and CDemoPane, respectively.

CDemoApp contains no special instance variables or new methods. It is similar to the Application subclass in any of the examples included with Think C. CDemoDoc is similar to the Document subclass in any of the examples included with Think C, but I have modified the `BuildWindow()` method to create the tool palette. CDemoPane contains three methods that control the cursor shape. These change depending on the palette tool chosen.

For the sample program, I created two other subclasses: CIconButton and CPalettePane. CIconButton is a subclass of CIconPane. CIconPane is part of the standard TCL and is a subclass of CPane. CIconPane can draw an Icon or cicon resource, and it can behave as a button. The sample program requires the subclass CIconButton to perform functions that CIconPane does not support, such as highlighting only one icon button at a time, handling the swapping of icons whenever a user double-clicks on a control, and displaying a specific cursor whenever the

icon button is active.

CPalettePane is a subclass of CPane, but it's nearly identical to the TCL class CRadioGroupPane, which simply supervises a set of radio buttons. CPalettePane behaves similarly by controlling the on and off states of the palette buttons. My sample program requires CPalettePane because CRadioGroupPane assumes it is using objects of type CRadioControl, not CIconButton. And unlike CRadioGroupPane, CPalettePane also handles different cursors for the different icon buttons it controls.

Even though inheritance is an important part of OOP, it is good only for describing what methods and instance variables are shared between classes. It does not explain how the classes interact with each other. For example, while most applications have windows, the Window class is not a descendant of the Application class.

As another example, you might think from looking at figure 1 that the Desktop class directly interacts with the View class, because CDesktop is a subclass of CView. This is not true, because these are only inheritance relationships. Each class inherits

all its methods and instance variables from its superclass. Therefore, a Desktop is a View, a Desktop acts as a View, and a Desktop responds to messages as a View would.

The question now is how library classes interact with each other. How do objects receive messages to draw windows and their contents? How does an application know what to do when a user clicks? The answers to these questions lie in the interaction relationships defined in other class organization structures. These other structures control two types of operations that occur in all Macintosh applications: displaying information and executing commands. Any Macintosh class library must handle these two operations. The TCL implements displaying information and executing commands in two distinct structures. But before I begin explaining these other structures, you must understand the starting gate of all TCL messages.

### The Switchboard

The key to displaying information and executing commands is in how the TCL interacts with the Macintosh Event Manager. Any Macintosh programmer knows that



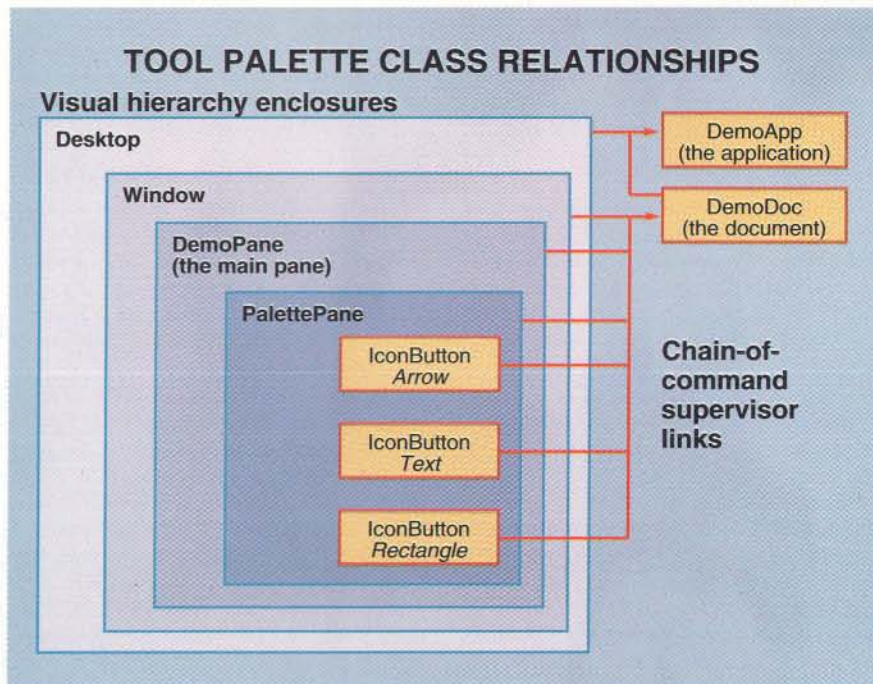
the Event Manager is the application's connection to the real world. The Event Manager intercepts any mouse-clicks, key presses, disk insertions, or network activity and dispatches them to the application. Therefore, to construct Macintosh applications properly, class libraries must have a connection to the Event Manager. The CSwitchboard class is the TCL's connection to the Event Manager.

CSwitchboard is not an abstract class. In fact, it is robust enough that you should never have to create a subclass for developing applications. The tool palette example uses an unmodified CSwitchboard.

A method within CSwitchboard calls `WaitNextEvent()`. After getting an event record, the switchboard determines the type of event and dispatches it appropriately. This dispatch starts the actions needed to display information or execute commands.

## Displaying Information

Macintosh class libraries usually have a structure that supports displaying information. The classes in the TCL that do this are part of the visual hierarchy and are descendants of the View class. The



**Figure 2:** The class relationships for the visual hierarchy and chain of command in the tool palette example. Note that the views are also in the chain of command.

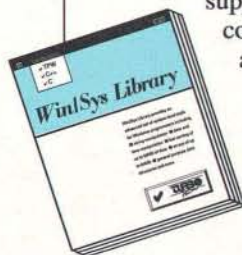
## TPW, C, and C++ Programming Tools for Windows

# System Routines for Powerful Windows Programming

**Win/Sys Library** provides an advanced set of system-level tools to put real horsepower behind Windows applications. Essential routines let you focus on the unique features of *your* program:

- A comprehensive set of string manipulation functions
- Date and time manipulation with international support
- Fast 1D and 2D arrays up to 64 MB of any data type
- Fast sorting of up to 64 MB of data
- General purpose data structures for bitsets, dictionaries, string tables, stacks, trees, and queues
- DPMI access for advanced interrupt and memory control
- Timing, delay, and sound functions
- Exception error trapping and recovery
- Heap analysis tools to help find memory leaks
- DOS functions for drive control and environment access
- Fast inline functions for common low-level data manipulation

Win/Sys Library requires TPW, BC++, TC++, or MS C/C++ 7.0. Satisfaction guaranteed or your money back within 30 days. Includes dual media. Add \$10 per order for shipping in U.S. and Canada, add \$20 per item for international airmail. Owners of TurboPower DOS products may purchase Win/Sys Library for \$89 until October 31, 1992.



## For C, C++, and TPW

The Win/Sys Library routines are provided in a DLL with interface modules for Turbo Pascal for Windows, Borland C++, and Microsoft C/C++ 7.0. The functions are fully optimized for Windows protected mode operation.

## Full Source and No Royalties

Win/Sys Library includes comprehensive printed documentation, plenty of working example programs, and a Windows help file. You get telephone and CompuServe support direct from the authors. Full source code is included (DLL is in Pascal and assembly). You pay no royalties.

**Win/Sys Library,  
only \$149.**

Call toll-free to order.

**1-800-333-4160**



9AM - 5PM MST Monday through Friday, U.S. and Canada.  
For more information call (800) 333-4160, fax to (719) 260-7151,  
or send mail to CompuServe ID 76004.2611. Int'l orders (719) 260-9136.  
TurboPower Software PO Box 49009 Colorado Springs, CO 80949-9009  
© TurboPower Software. 1992



visual objects that a user sees are known as *views* because of their ancestral relationship with the View class. These visual objects include the Mac Desktop, windows, and panes within windows. In figure 1, the Desktop, Window, and Pane classes are all Views.

While inheritance relationships link classes in the class hierarchy, *enclosures* link CView, CDesktop, CWindow, CPane, and the other classes in the visual hierarchy. The all-encompassing enclosure is the Mac Desktop, which is at the top of the visual hierarchy. Enclosed within the Mac Desktop are windows, and within windows are panes. A pane within a window is an example of a *subview*—a view enclosed by another view.

Glance at your Mac's screen, and you will see the general relationships between the classes associated with the visual hierarchy. The view that fills the screen is the Mac Desktop, and on the Desktop are windows. A subview of a window is typically a pane. Panes present text, graphics, and even controls to the user.

As a Macintosh Toolbox programmer, you know that all drawing on a Mac occurs in windows, not directly on the screen.

You must now understand that all drawing using the TCL occurs in panes and that panes can be nested. Each pane has its own QuickDraw drawing environment, so you can draw in a pane without worrying about its location.

In my sample program, the Mac Desktop encloses the window, and the window encloses several panes. The IconButtons and the PalettePane are all Panes and are therefore part of the visual hierarchy. The IconButtons are subviews of the PalettePane, and the PalettePane is a subview of the Window object.

Even though views may have subviews, be careful not to think of views as having inheritance relationships. While the Mac Desktop encloses a window, a CWindow is not a CDesktop. Enclosures form the relationship link in the view hierarchy.

I have discussed how enclosures link visual objects. These visual objects communicate with each other and to the application by way of *visual events*. The visual hierarchy can accept and act on these events, which consist of actions from the user or messages from other objects. Visual events from a user include mouse-clicks and cursor adjustments. Visual events from

other objects include toolbox activate and update events.

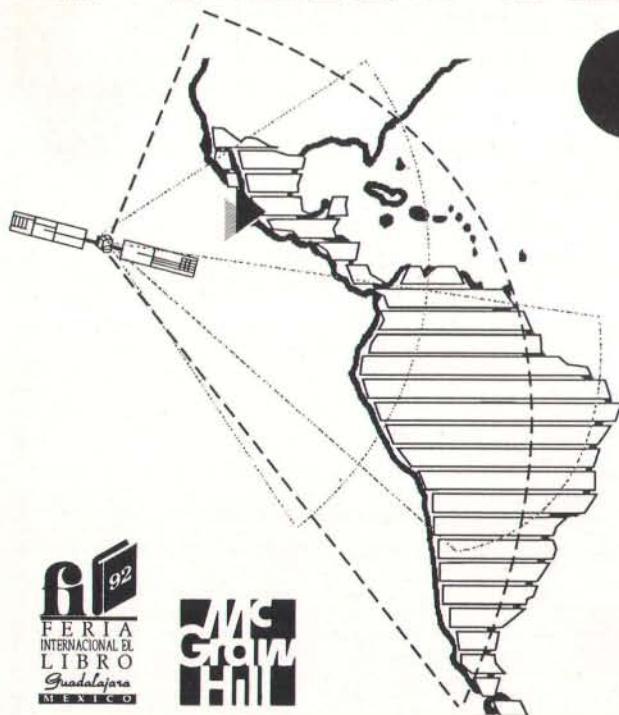
Activate or update visual events always have a window associated with them, so the calling object sends these messages directly to the window object. For example, if the Switchboard discovers an update event, it sends an `Update()` message to the window requiring the update. The window then sends `Draw()` messages to each of its subviews (generally panes), instructing each of them to perform their required drawing updates. Each view only needs to know how to draw itself through its `Draw()` method. This feature shows a definite advantage of using OOP and class libraries.

All mouse-click and cursor-adjustment visual events start at the top of the visual hierarchy. If the Switchboard receives a mouse-down event, the Desktop object is first to receive a visual event, since it is the view that encloses all others. The Desktop object then determines whether the cursor is within the menu bar, a desk accessory, or a window. If the cursor is in the drag, go-away, zoom, or grow region of a window, the Desktop object sends the appropriate message to that window.

# Latinet'92

## Integración total

EXPO-GUADALAJARA  
Noviembre 30 a Diciembre 4



Una exposición de tecnología de punta en redes y telecomunicaciones que reunirá a más de **50** empresas en su ramo ...

### ► Conferencias para directores y ejecutivos de alto nivel:

estudios de casos, actualización sobre tecnologías de redes, edificios inteligentes, planeación estratégica ...

- Bases de datos distribuidas • Aplicaciones
- Correo electrónico • Interoperabilidad

### ► Tutoriales para técnicos y especialistas en redes y telecomunicaciones.

### ► Demostraciones en vivo de lo más reciente en redes, automatización de oficinas, fibras ópticas ...

- Servidores de red • Software para redes
- Fibra óptica • Token Ring • Ethernet

Informes: Apdo. Postal 39-130, Guadalajara, Jal., México 44170  
Fax (3) 625-1000, 625-7359





**Listing 1:** The DoClick() method in CIconButton. This method runs when a user clicks on an icon button.

```
void CIconButton::DoClick(Point hitPt, short
    modifierKeys, long when)
{
    short          iconSwap;
    if ( gClicks == 1) {          // Only a single-click
        if ( GetValue() != BUTTON_ON) {
            SetValue( BUTTON_ON);
            if ( clickCmd != cmdNull)
                itsSupervisor->DoCommand( clickCmd);
        }
    } else if ( gClicks == 2) {    // User dbl-clicked
        if ( secondIconID != (short)0) {
            iconSwap = iconID;      // Swap icon IDs
            iconID = secondIconID;
            secondIconID = iconSwap;
            // Load new icon
            CIconPane::IIconPaneX( fPreferColor);
            SetValue( BUTTON_ON);    // Draw new icon
        }
        if ( dblClickCmd != cmdNull)
            // Send dbl-click cmd
            itsSupervisor->DoCommand( dblClickCmd);
        // Set cursor to appropriate symbol
        BroadcastChange( cursorChanged, &cursorID);
    }
    /* CIconButton::DoClick */
}

END
```

If the cursor is within the content region of a window, then the Desktop object sends a DispatchClick() message to that window. The window then determines the subview within which the cursor appears and sends a DoClick() message to that subview. The subview will probably consist of a pane enclosed by the window.

The sample program consists of a Mac Desktop with a window, a PalettePane, and a series of IconButtons. The DemoPane sits within the window. If a user clicks on an IconButton, the Switchboard sends a DispatchClick() message to the Window object. The Window object then locates the subview where the mouse-down occurred (the IconButton object) and sends it a DoClick() message.

Another advantage of using class libraries should now be evident: Classes that have already been created handle all the visual event dispatching, including calling the TCL methods DispatchClick() and DoClick(). The only thing that needs to be done in the tool palette example is to define what the IconButtons will do when the user clicks on them. To define these actions, you must override the DoClick() method from the CIconPane class, as shown in listing 1.

DoClick() first checks for a single- or double-click by reading the TCL global variable gClicks. (The Switchboard

object sets gClicks to the number of mouse-clicks.) If the user initiates a single-click, the program calls GetValue() to ensure that the button is not already on before making a call to SetValue() to turn on the button.

If the user initiates a double-click, the program checks for a non-null value in the instance variable secondIconID to determine whether a second icon is available. If so, DoClick() loads the second icon. It does this by swapping icon resource IDs with iconID, an inherited instance variable from CIconPane, and then calling the inherited method IconPaneX(). IconPaneX() already handles the actual loading of an icon resource. The example simply takes advantage of the features of an inherited method.

There are no Draw() methods in the subclasses created in this example. The superclass to CIconButton, CIconPane, has a Draw() method, and since CIconButton is a subclass of CIconPane, it inherits CIconPane's Draw() method. The Draw() method in CIconPane calls another CIconPane method, DrawIcon(). SetValue() in CIconButton calls the same method. Here again, I am taking advantage of an inherited method.

Although CPalettePane is a pane, it is not visible to the user. It exists simply to enclose the icon buttons for control

To get a good idea of what a great idea we have in Image Watches, paste your color logo here.



Water-Resistant Case

OR EVEN BETTER...

## SEND US YOUR COLOR LOGO

(Any size letterhead, business card or finished logo design which need not be returned.)

along with \$14.50\* each

\*Tax and shipping included  
(Special 1/2 Price Introductory Offer)

and we'll rush you a personalized working quartz watch sample as our convincer!

Your company logo in full color on the dial of a deluxe, water-resistant wristwatch. 18K Goldplated case, water-resistant leather strap, battery powered quartz movement with a lifetime limited warranty. Remarkably inexpensive even in small quantities.

### Compare our Service!

- Upon receipt of your finalized, company approved color logo, count on 10-working-day turnaround from receipt of order to shipment, sooner if needed!
- Free re-do if not satisfied
- Lifetime limited warranty
- Money back guarantee, no questions asked!

To dispel any confusion from imitators we stamp our name on the back of each watch.

Please look for this seal of excellence.



(Limit: 2 samples per company @ \$14.50 each)  
Catalog sheet and details on request.

## IMAGE WATCHES,™ INC.

Attention: Mr.

9095 Telstar Ave.

El Monte, CA 91731-2809

(818) 312-2828 • (800) 344-8050

9 AM - 5 PM Mon. - Fri. Pacific Coast Time

LOGO WATCH LEADER FOR OVER 10 YEARS

IMAGE WATCHES,™ INC. All Rights Reserved

Unconditional Money Back Guarantee

OCTOBER 1992 • BYTE 271



**SUNDAY 10-5**

**NOTEBOOK LAPTOP**  
**AST PREMIUM EXC 1986 SX**  
 25 MHZ 4 MB 60 HD ..... \$2149.99  
 25 MHZ 4 MB 80 HD ..... \$2149.99  
 25 MHZ 4 MB 120 HD ..... \$2594.99  
 Color 25 MHZ 80 HD ..... \$1794.99  
**Compaq Contura 386 SL 25 MHZ**  
 4 MB 60 HD ..... \$1794.99  
 4 MB 120 HD ..... \$2098.99  
**Compaq LTE Lite**  
 20 MHZ 2 MB 80 HD ..... \$2349.99  
 20 MHZ 4 MB 80 HD ..... \$2984.99  
 25 MHZ 4 MB 80 HD ..... \$4149.99  
 25 MHZ 4 MB 120 HD ..... \$4149.99  
 Color 4 MB 84 HD ..... \$2349.99  
 Color 4 MB 120 HD ..... \$2349.99

**HEWLETT PACKARD**  
 Paintplot PC 95 512K ..... \$549.99  
 Paintplot PC 95 LX 1 MB ..... \$1749.99  
**SHARP 386 SL**  
 PC 6781 80 HD ..... \$2449.99  
 PC 6981 SL 80 HD Color ..... \$2449.99

**TEXAS INSTRUMENT**  
 4000 486 SX 80 HD ..... \$2049.00  
 4000 486 SX 120 HD ..... \$2324.99

**TOSHIBA**  
 T-2200 SX 80 HD ..... \$2134.99  
 T-3300 SL 80 HD ..... \$2134.99  
 T-3300 SL 120 HD ..... \$2134.99  
 T-4400 SX 120 HD ..... \$4499.99  
 T-4400 SX 120 Gs Plasma ..... \$4499.99  
 T-4400 SX 80 HD Color ..... \$3779.99  
 T-4400 SX 120 HD Color ..... \$4679.99  
 T-6400 SX 120 HD ..... \$4679.99  
 T-6400 DXC 200 Color ..... \$4679.99

**NEC**  
**EXECUTIVE ORGANIZER**  
 Casio SF 4300 32KB ..... \$49.99  
 Casio SF 5300 32KB ..... \$69.99  
 Casio SF 8000 64KB ..... \$94.94  
 Casio SF 9500 64KB ..... \$144.99  
 Casio SF 9700 64KB ..... \$194.99  
 Sharp ZO 5200 64KB ..... \$194.99  
 Sharp IQ 8200 128KB ..... \$194.99  
 Sharp IQ 8400 256KB ..... \$299.99

**LASER PRINTER**  
**Hewlett Packard**  
 Desk Jet 500 Color ..... \$594.99  
 Desk Writer Color ..... \$749.99  
 HP Laser IIIP Plus ..... \$1394.99  
 HP Laser IIIP ..... \$1394.99  
 HP LaserJet III ..... \$349.99  
 HP LaserJet IIIS ..... \$114.99  
 1 MB Memory ..... \$234.99  
 2 MB Memory ..... \$269.99  
 Pac 25 in 1 ..... \$699.99  
 Pacific Page XL ..... \$699.99

**Okidata**  
 Okidata 400 ..... \$594.99  
 Okidata 800 ..... \$894.99  
 Okidata 810 ..... \$1284.99  
 Okidata 830 ..... \$139.99

**Panasonic**  
 KXP-4410 ..... \$609.99  
 KXP-4450 ..... \$114.99  
 1 MB Memory ..... \$114.99  
 2 MB Memory ..... \$114.99

**SCANNERS**  
 HP Scanjet Plus w/IF ..... \$499.99  
 HP Scanjet II ..... \$1399.99  
 HP Scanjet II Color ..... \$1399.99

**PRINTERS**  
 Canon BJ-300 ..... \$259.99  
 Epson LQ-570 ..... \$429.99  
 Epson LQ-870 ..... \$584.99  
 Epson LQ-1070 ..... \$864.99  
 Epson LQ-1170 ..... \$864.99  
 Epson LQ-2550 ..... \$219.99  
 Epson 3250 24 Pin ..... \$299.99  
 Fujitsu DL-1200 ..... \$414.99  
 Okidata ..... \$424.99  
 Okidata 321 ..... \$574.99  
 Okidata 380 ..... \$894.99  
 Okidata 390 Plus ..... \$194.99  
 Okidata 391 Plus ..... \$274.99  
 Okidata 393 Plus ..... \$334.99  
 Panas. KXP 1180i ..... \$164.99  
 Panas. KXP 1123 ..... \$164.99  
 Panas. KXP 1124 ..... \$314.99  
 Panas. KXP 1624 ..... \$314.99  
 Panas. KXP 2180 ..... \$364.99  
 Panas. KXP 2123 ..... \$364.99  
 Panas. KXP 2124 ..... \$364.99  
 Panas. KXP 262A ..... \$304.99

**PRINTERS FLAPOS**  
 Canon BJ 10 ex ..... \$299.99  
 Citizen NP 48 ..... \$284.99  
 Diconix 180 SL ..... \$349.99

**FAX**  
 Canon Fax 40 ..... \$384.99  
 Canon Fax 50 ..... \$484.99  
 Pana. KXF-50 ..... \$484.99  
 Pana. KXF-60 ..... \$484.99  
 Pana. KXF-90 ..... \$489.99  
 Pana. KXF-110 ..... \$1024.99  
 Pana. KXF-128M ..... \$1024.99  
 Pana. UF-311 ..... \$999.99  
 Pana. UF-312 ..... \$999.99  
 Pana. UF-200 ..... \$999.99

**PROMPT DELIVERY**

**IBM**

**EVEREX**

**HP**

**NEC**

**NOVELL**

**TOSHIBA**

**EVEREX**

**HP**

**NEC**

**NOVELL**

**TOSHIBA**

**EVEREX**

**IBM**

**EVEREX**

**HP**

**NEC**

**NOVELL**

**TOSHIBA**

**EVEREX**

**IN USA & CANADA & P.R.**  
**INCLUDING NY STATE**  
**1-800-874-1235**  
 Fax: (212) 463-8335 (Include Voice & Fax #)  
**S & W COMPUTERS & ELECTRONICS**  
 31 West 21 Street, New York, NY 10010  
 NYC (212) 463-8330  
 Hours Sun. 10-5  
 Mon. Thurs. 9-6 Fri. 9-145  
 Saturday Closed

**PRICES HARD TO MEET — SERVICE HARD TO BEAT! World Wide Inquiries Promptly Filled**

## SOME ASSEMBLY REQUIRED

purposes. I named it `CPalettePane` to show its similarity to `CRadioGroupPane`, but a name like `CPaletteController` might be more appropriate.

The calls to `DoCommand()` and `BroadcastChange()` in listing 1 don't seem to fit in with the discussion of the view hierarchy and visual events. These methods are actually part of a third structure in the TCL, which is responsible for executing commands.

## The Chain of Command

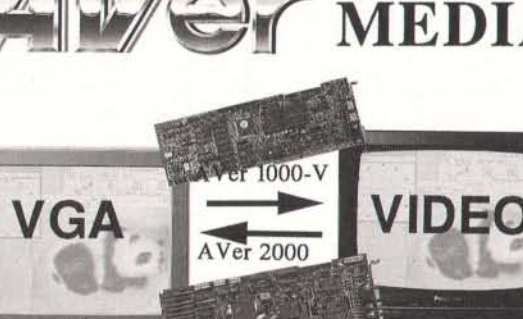
Macintosh class libraries usually have a structure that supports executing commands. Classes in the TCL that control the execution of commands are part of the *chain of command*. All objects associated with the chain of command are descendants of the CBureaucrat class; thus, the chain of command is sometimes called the *bureaucrat hierarchy*, and the objects in the chain of command are called *bureaucrats*. Note that since View is a subclass of Bureaucrat, it is also a bureaucrat. Therefore, all views are also in the chain of command.

Another important subclass of CBUreaucrat is CDirector, which supervises a Window. A subclass of CDirector is CDocument. A Document has a file associated with it, so it is the bureaucrat that coordinates windows and files.

Views, Directors, Documents, and other classes in the chain of command communicate by *direct commands*. The process is similar to the visual hierarchy's communication by visual events. A direct command is a request that an object perform some action. It usually results from a key press or menu selection. If the user chooses Quit from the File menu, the program sends a Quit command to the application object. If the user chooses Paste from the edit menu, the program sends a Paste command to an active pane.

The `DoCommand()` method, found in every class in the bureaucrat hierarchy, handles direct commands. If this method in an object does not recognize a command, it passes the command to its *supervisor*. Just as the view hierarchy uses enclosures to form the links between classes, the chain of command uses the concept of supervisors to form its links. If an object within the TCL cannot act on a command, it sends the command to its supervisor, the next object to attempt to handle a command. The instance variable `itsSupervisor`, defined in `CBureaucrat`, always points to an object's supervisor.

To send a direct command to a bureaucrat, you simply send the message `DoCommand(aCommand)`. `DoCommand()` contains a switch statement with the




# Aver<sup>TM</sup> MULTI-MEDIA

**AVer 1000-V (NTSC or PAL)**

- VGA to TV Card, w/Broadcasting Video Quality
- VGA Chip (ET-4000) on board
- Flicker-Free Filter on board
- Two Types: 256 or 32K Colors
- Video Resolution.  
800\*600(PAL), 640\*480(NTSC)
- Provides Video output for AVer 2000

**AVer 2000 (NTSC & PAL)**

- PC-based Frame Grabber
- Displays Scalable Live Video Window on VGA Monitor under WINDOWS or DOS
- Supports TIFF, PCX, BMP, TGA, YUV... file formats
- Option: S-Video Input, Temptra S/W



DISTRIBUTOR  
WELCOME

**We also have:**

- VGA to TV OVERLAY/GENLOCK Card
- VGA to NTSC Card
- POCKET VIDEO
- TUNER Card
- JPEG Compression Card
- TARGA 16 Compatible Card

**MANUFACTURED BY:**

ADDA (USA, CA)	TEL: 1-510-7709899	FAX: 1-510-6231803
ADDA (CANADA, BC)	TEL: 1-604-2783224	FAX: 1-604-2782909
ADDA (TAIWAN)	TEL: 886-2-2484131	FAX: 886-2-2484276, 886-2-2404538

All the trade marks are the property of their respective holders.



possible commands that can be handled in each case condition. If the command number does not equal one of the case conditions, the bureaucrat cannot handle the command, which is then automatically sent to the bureaucrat's supervisor through the default condition of the following switch statement:

```
default:
    itsSupervisor->
        DoCommand(aCommand);
    break;
```

Since it is at the top of the chain of command, the Application class does not have a supervisor. If the Application object can't handle a command, no object can.

The top of the chain of command in the sample program is the Application object CDemoApp. CDemoDoc is one of its subordinates. CDemoDoc supervises all other objects, including the window, CDemoPane, CPalettePane, and CIconButtons. Figure 2 shows the general relationships that exist between the classes associated with the chain of command and the visual hierarchy.

The tool palette example has code that

could associate command numbers with each palette control. If a click command is defined, a DoCommand() message is sent to the document—the button's supervisor—when the user clicks on an icon button. Listing 1 shows this action. Sending the message SetClickCmd(command-Number) to an icon button sets the command number for that object.

There is also a separate set of command numbers for double-clicks on a control. If a double-click command is defined, the program sends it to the button's supervisor when the user double-clicks. Sending the message SetDoubleClickCmd(command-Number) to an icon button sets the double-click command number for that object.

To simplify the example, command numbers have not been defined, so the overridden method DoClick() does not send DoCommand() messages. The example does use standard TCL commands, such as New, Close, and Quit. You can add a command to change the drawing mode if the user double-clicks on the rectangle tool button. If the user double-clicks, then the program sends the defined double-click command to the button's supervisor,

CDemoDoc. CDemoDoc then takes whatever action is necessary to change between outline-only and filled-drawing modes.

Direct commands use supervisors to form a hierarchy in the chain of command. However, communication can also occur between objects without a supervisory relationship. This is called *collaboration*.

## Collaboration

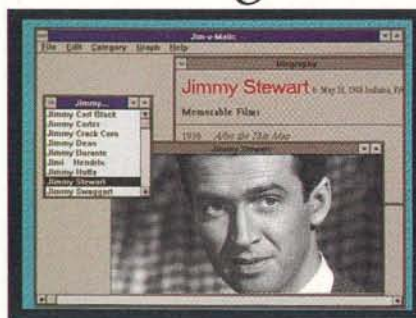
Every bureaucrat is a descendant of the class CCollaborator. A collaborator allows peer-to-peer communication between objects through dependencies. When you set up a dependency, one collaborator becomes the provider, and the other becomes the dependent. To set up a dependency, you simply send the dependent object a DependUpon(aProviderObject) message.

When a critical property has changed or an action has occurred, an object notifies its dependents through the method BroadcastChange(reason, info). To receive broadcasts of changed providers, dependent objects must include the method ProviderChanged(aProvider, reason, info). The reason and info parameters pass directly from the provider

# Not since Jimmy Stewart has there been such a combination of character and good looks.



C-scape® lets you easily create handsome and completely portable character-based applications with integrated graphics.



C++/Views™ lets you easily create handsome and completely portable applications for MS Windows and other GUI environments.



We offer a complete line of user interface toolkits to make your applications become stars. Even better, our toolkits let your applications appear on screens everywhere—from DOS to Windows to UNIX and more—without modification.

## C-scape. The most flexible user interface package

C-scape provides you with a library of powerful windowing functions such as scrolling windows, mouse support, and graphics. Look & Feel®, C-scape's interactive screen designer, makes prototyping and code generation almost effortless. C-scape supports both text and graphics mode.



## C++/Views. The leading C++ class library.

C++/Views has over 100 proven and portable C++ object classes for GUI development. These classes shield you from the underlying GUI environment and API—slashing development time on GUI programming up to 75%. C++/Browse®, a powerful source code browser comes free with C++/Views, as does a sophisticated documenter.

Call +44 (0)71 799 2434. FAX +44 (0)71 799 2552. Call for a free demo today. Both products come with source code—FREE.

# LIANT

All trademarks belong to their respective companies. Copyright © 1993 by Liant Software Limited, 2 Caxton St., St. James Park, London SW1H 0QE, United Kingdom. C-scape for DOS £359. C++/Views for MS Windows £299. Call for pricing on other platforms.



to the dependent. The `aProvider` parameter tells the dependent which provider sent the broadcast.

The tool palette example uses two types of collaboration: The `CDemoPane` class is dependent on `CPalettePane`, and each of the `CIconButtons` are dependent on the `CPalettePane`. When the user chooses a new tool, the `SetValue()` method in the `CIconButton` class sends a broadcast. The `CPalettePane` object intercepts the broadcast through its `ProviderChanged()` method, which has been overridden from the `CBureaucrat` class.

The overridden `ProviderChanged()` method turns off the previously selected tool since it has an instance variable, `currentStation`, that points to the selected tool object. The `ProviderChanged()` method in `CPalettePane` is identical to the method in `CRadioGroupPane`, except that references are made to `CIconButton` instead of to `CRadioControl`.

The `DoClick()` method in `CIconButton` sends another broadcast when a tool is changed to indicate a change in the cursor shape. The `info` parameter is `cursorID`, an instance variable in `CIconButton` that contains the cursor resource ID

for that tool. The `CPalettePane` class also intercepts this second broadcast, but immediately rebroadcasts it. The `CDemoPane` class receives this second broadcast (since it is dependent on `CPalettePane`) and adjusts the cursor accordingly.

Like the `ProviderChanged()` method in `CPalettePane`, `ProviderChanged()` in `CDemoPane` is overridden from `CBureaucrat`. `ProviderChanged()` simply sets the `CDemoPane` instance variable `cursor` equal to the `info` parameter. When the Switchboard sends an `AdjustCursor()` message, the `CDemoPane` instance variable `cursor` is used to specify a cursor resource.

## Starting Point

My toolbox example serves as a starting point for a drawing or painting application. In addition, it shows how you can use a tool palette to control any general application. Adding commands for single- or double-clicks and specifying color icons (instead of black and white) are a couple of easy ways to extend the capabilities of this program.

Classes within libraries have other relationships besides inheritance. Completely

different structures form when information is displayed or commands are executed. If you thoroughly review the TCL or any other class library, you will find a complex, yet robust, set of program code. The expanse of a class library is intimidating, and it may well take months for you to become familiar with the majority of classes. However, the time you invest will pay off in faster development times in the long run.

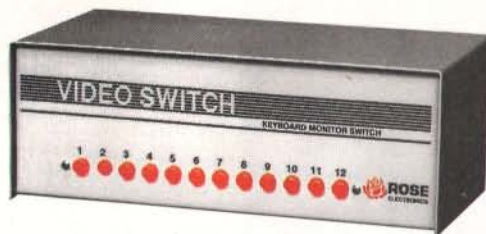
Class-library reference manuals usually describe the individual classes very well. But only by studying sample code will you understand how the various classes interact. ■

Editor's note: Complete class listings for the sample program are available on BIX. Look for "tools.sit" in the "frombyte92" listings subarea.

James H. Parshall is a computer systems consultant and graduate student at Purdue University's school of electrical engineering. He uses the TCL for developing client-server applications. You can reach him on BIX c/o "editors" or on the Internet at [parshall@ecn.purdue.edu](mailto:parshall@ecn.purdue.edu).

# Your Choice of Keyboard Monitor Switches

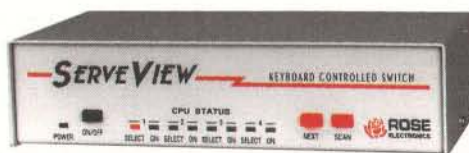
Access multiple computers with a single keyboard and monitor to cut equipment costs, save valuable space, and end clutter



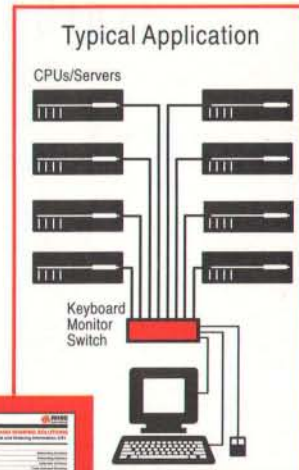
Manually controlled unit

- Simple pushbutton operation for quick selection
- Four, eight, or twelve ports per unit
- Daisy-chaining connects unlimited number of CPUs
- Compatible with EGA, VGA, Macintosh, Sun, and others
- Optional keyboard booting for 286, 386, and 486
- Optional RS232 or PS/2 mouse interface
- PCB construction for high reliability and low crosstalk
- Rack mount, matrix, and customized units available

- Switch by keystroke, from front panel, or RS232 port
- Two or four ports per unit
- Cascade units to support up to 255 CPUs
- Supports monochrome, EGA, and VGA
- Includes keyboard booting for 286, 386, and 486
- Includes RS232 and PS/2 mouse interface
- LEDs display selected CPU and CPU power-on
- Scan function switches among CPUs automatically



Keyboard controlled unit



Call toll-free now for your copy of our Switching and Sharing Solutions catalog.

Other Rose products: Print servers, printer sharing units, print buffers, keyboard monitor extenders, video splitters. All Rose products are US-made and have a 1-year warranty.

# Make the Rose Connection

10850 Wilcrest Drive • Houston, Texas 77099 • Phone (713)933-7673 • Fax (713)933-0044

**ROSE**  
ELECTRONICS

1-800-333-9343

Circle 162 on Inquiry Card.



## ADA COMPILERS

IntegrAda	DOS	£199
IntegrAda/386	386->DOS	£375
Janus/Ada Compiler	DOS	£69
Janus/Ada PDS	386->DOS	£340
OpenAda DOS	DOS	£260
OpenAda DOS 286	286	£495
OpenAda DOS 386	386	£695

## ASSEMBLERS

MS MASM PDS v6	OS2&DOS	£75
PharLap 386DOS Ext SDK	DOS	£330
PharLap 386ASM/Linkloc	DOS	£830
Optasm	DOS	£125
Turbo Debugger & Tools	DOS	£89

Not all assemblies are supplied with a linker.  
Check before ordering.

## LOW PRICES

FOR  
MICROSOFT & BORLAND  
PRODUCTS

Microsoft C/C++ 7.0	£222
Microsoft C/C++ Upgrade	£99
Microsoft Cobol 4.5	£435
Microsoft Fortran 5.1	£205
Microsoft Macro Assembler 6.0	£75
Microsoft Pascal 4.0	£139
Microsoft QuickC 2.5	£50
Microsoft QuickC & Assembler	£83
Microsoft QuickC for Windows	£95
Microsoft QuickPascal 1.0	£50
Microsoft Source Profiler	£45
Microsoft Test for Windows	£185
Microsoft Visual Basic	£95
MS Visual Basic for DOS Std	£95
MS Visual Basic for DOS Prof	£222
Microsoft VB Prof Toolkit	£135
Microsoft Windows 3.1	£70
MS Windows SDK 3.1	£165
Borland C++ 3.1	£199
Borland C++ & AFX 3.1	£295
Borland Corporate Prod Pack	£330
dBase IV 1.5	£335
ProtoGen for Borland C++	£39
Turbo C++ 3.0	£50
Turbo C++ & Turbo Vision 3.0	£70
Turbo C++ for Windows 3.1	£85
Turbo Debugger & Tools	£89
Turbo Pascal 6.0	£69
Turbo Pascal Professional 6.0	£137
Turbo Pascal for Windows 1.5	£103
Turbo Vision 1.1	£25
Paradox 3.5	£335
Paradox Engine 2.0	£199

## C LIBRARIES & TOOLS

Comms		
C Asynch Manager	DOS	£110
C Comms Toolkit	DOS	£89
COMM-DRV	DOS	£59
Essential Comms	DOS	£170
Greenleaf CommLib 3.2	DOS	£175
Silvercomm C Asynch	DOS	£125
Database		
Btrieve	Win,DOS	£310
C-tree Plus	DOS	£310
CodeBase 4.5	DOS	£195
D-ISAM	DOS	£275
Faircom Toolbox Prof	DOS	£645
Pro-C v2.1	DOS	£99
Pro-C v2.5	DOS	£485
Raima Data Manager	Win,DOS	£410
SoftFocus Btree/ISAM	DOS	£70
Sycero.C Network	DOS	£895
Graphics		
Essential Graphics Chart	DOS	£105
Essential Graphics Kernel	DOS	£110
Essential Graphics GUI	DOS	£79
GraphicC 6.0	DOS	£260
graphics-MENU & Data Entry	DOS	£155
GSS GDT	OS2,DOS	£395
GX Graphics 2.0	DOS	£135
HALO Professional 2.0	DOS	£210
MetaWINDOW 4/32	DOS	£230
PCX Toolkit 5.0	DOS	£135
Real-Time Graphics & M/CT	DOS	£125
TEGL Windows Toolkit II	DOS	£65
TurboWINDOW 4/32	DOS	£115

# GREY MATTER

Prigg Meadow, Ashburton, Devon TQ13 7DF

Prices do not include VAT or other local taxes, but do include delivery in the UK and Europe.

Please check prices at time of order as ads are prepared some weeks before publication.

This page lists some of our products - call us for a complete price list and details of discount structure.

ORDER BY PHONE WITH YOUR CREDIT CARD

**TEL: (0364) 53499**

FAX: (0364) 53071

## C & C++ WINDOWS LIBRARIES

Btrieve	Win	£310
CodeBase 4.5	Win&DOS	£195
dAnalyst Gold	Win&DOS	£230
POET	Win	£270
C++/Views 2.0	Win	£270
C++/Views 2.0 Competitive U/G	Win	£99
Control Palette for Windows	Win	£85
ObjectGraphics for C++	Win	£159
ProtoGen	Win	£55
ProtoGen for Borland C++	Win	£39
ProtoView	Win	£299
Win++	Win	£145
WindowsMaker Pro	Win	£575
zApp	Win	£125
zApp w/Source	Win	£175
zApp w/Source	Win&DOS	£280
zApp for Windows NT	NT	£235
Zinc 3.0 w/Source	Win&DOS	£200

## BASIC LANGUAGES

### BASIC COMPILERS & INTERPS

NEW VISUAL BASIC FOR DOS STANDARD combines QuickBasic/PDS compatibility with the event-oriented programming model & rich user-interface tools of Visual Basic. ONLY £95.

PROFESSIONAL EDITION adds an optimising compiler, integrated ISAM, charting/presentation graphics, custom control development kit, and MOVE overlays (from C/C++ 7.0). ONLY £222.

UPGRADES to STANDARD from QuickBasic ONLY £79.

UPGRADES to PROFESSIONAL from QuickBasic, Basic PDS, or Visual Basic for Windows ONLY £149.

GFA-BASIC	DOS	£85
GFA-BASIC for Windows	Win	£170
MS Visual Basic	Win	£95
MS Visual Basic for DOS Std	DOS	£95
MS Visual Basic for DOS Prof	DOS	£222
PowerBASIC	DOS	£110
Realizer	Win	£275

### LIBRARIES & UTILITIES

#### Communications

Comms Lib (Microhelp)	Win,DOS	£90
PDQ Comm	DOS	£59

#### Database

Btrieve 5.1 (QB,VB)	DOS,Win	£310
CodeBasic (VB)	Win	£160
db/Lib Prof	DOS	£120
E-Tree Plus	DOS	£160
ObjectTrieve/VB	Win	£250
PowerLibW (VB)	Win	£195
VB/ISAM MX (VB)	Win	£75
Visual/db	Win	£105

### Graphics

ChartBuilder Control for VB	Win	£85
Graphics Workshop	DOS	£90
GraphPak Pro	DOS	£85
GX Graphics 2.0	DOS	£135
HALO Professional 2.0	DOS	£210

### General & Sundry Libraries

Microhelp Muscle (QB,VB)	Win	£130
PDQ	DOS	£95
ProBas 5.0	DOS	£140
QuickPak Pro	DOS	£120
QuickPak Pro for Win (VB)	Win	£120
QuickScreen	DOS	£89
Science & Eng Tools	DOS	£55
VBTools 2.0 (VB)	Win	£115

## DISK COPYING SERVICE

We can copy files to and from 600 disk formats including CP/M, CP/M-86, MS-DOS, PC-DOS, APPLE, SIRIUS, BBC, TORCH, APRICOT, HP-150, TRSDOS, AMSTRAD, ATARIST, MACHINTOSH.

Our charge is £10.00 + disk + VAT with discounts on small quantities and disks are normally despatched within 24hrs of receipt.

For more information call us.

## C & C++ COMPILERS

NEW BORLAND C++ 3.1 is now fully AT&T CFRONT 3.0 compatible, supports OLE, multimedia & True Type, colour syntax highlighting, UAE tracer, etc. ONLY £199 or £295 with AFX.

Aztec C86-c	DOS	£275
Borland C++ 3.1	Win&DOS	£199
Borland C++ & AFX 3.1	Win&DOS	£295
Microsoft C/C++ 7.0	Win&DOS	£222
Microsoft C/C++ Upgrade	Win&DOS	£99
MS QuickC 2.5	DOS	£50
MS QuickC & QuickAsm	DOS	£83
MS QuickC for Windows	Win	£95
Topspeed C Prof	Win&DOS	£165
Topspeed C++ Prof	Win&DOS	£165
Turbo C++ 3.0	DOS	£50
Turbo C++ for Windows 3.1	Win	£85
Watcom C 9.0	OS2&Win&DOS	£275
Zortech C++	Win&DOS	£370
High C/C++ 386 3.1	PL386	£475
Intel 386 C Code Builder	Win&386	£370
NDP 386 C	386	£545
Watcom C/386 9.0	Win&386	£485

## PROGRAMMING TOOLS

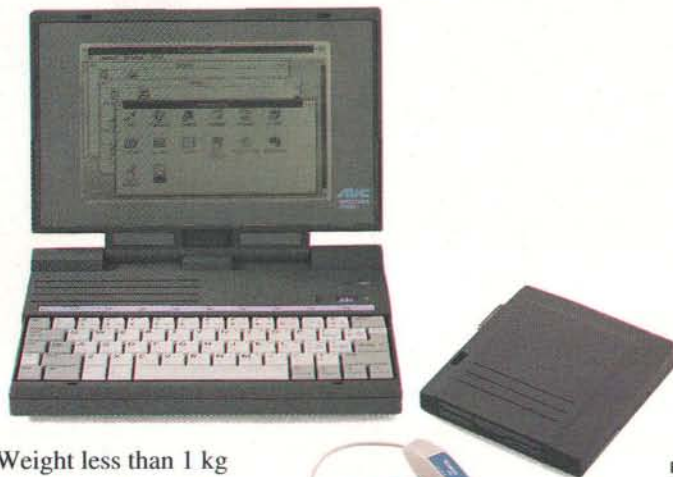
Ada	Algol
Assemblers	Awk
Basic	C
C++	Cobol
Comal	Comms
Cross Dev	Database
Debuggers	Editors
Forth	Fortran
Graphics	Icon
Linkers/Locaters	Lisp
Logo	Modula-2
Pascal	Prolog
Rexx	Smalltalk
Snobol4	Version Control
Windows	Yacc & Lex

We stock many items for which there is no space in these advertisements.



# TRAVEL LIGHT, TRAVEL NEAT, TRAVEL SMART...

## ABC BICOM B260i



- Weight less than 1 kg
- PCMCIA 2.0 Interface
- 60 Mb Hard Disk
- 2 Mb RAM
- No adapters needed
- 128k static RAM, 256k FLASH
- Enhance AT processor (Landmark 21.5MHz)
- Uses normal AA batteries
- Advanced power management and PIM
- Full DOS and Windows compatible



**Germany DM2375.-**  
**U.S.A. USD1450.-**

Denmark	(DKK)8800	New Zealand	(NZD)2700
Finland	(FIN)5900	Sweden	(SEK)7700
France	(FRF)7700	U.K.	(GBP)770
Italy	(ITL)1700000		

\*Except Germany all prices exclude sales tax.

### ABC Computer (U.S.A.) Corp.

2531, 237th Street, Suite 122, Torrance, California 90505, U.S.A.  
Tel: (310) 325-4005 Fax: (310) 325-6369

#### England

Suntec Corporation Plc  
Tel: (0372) 360606

Eagle Network Ltd.  
Tel: 081-6836413

#### Canada

Power Industry  
Tel: 403 463-3838

#### Denmark

Jebsen & Co. ApS  
Tel: 045-74 62 73 73

#### Sweden

EM2-Data AB  
Tel: 08-8-753 2020

PC direkt  
Tel: 031-400 470

AXXESS portabla datorer AB  
Tel: 08-660 1910

#### New Zealand

A B Computer Ltd.  
Tel: 04-4999000

#### Finland

Express Computer  
Tel: (90) 135 5899

#### Germany

HERTIE Waren-und Kaufhaus Gm  
Tel: 069-668 13395

Horten Aktiengesellschaft  
Tel: 0211-957 2418

OPCOM Datestechnik GmbH  
Tel: 089-904 4049

#### Italy

D. Top Europe  
Tel: 0445-953900

#### France

Gambetta Informatic  
Tel: 01/43 49 33 30

Grafelec  
Tel: 01/48 94 86 85



\*Please call for other dealers' information

\*All brand names are registered trademarks of their respective owners.

\*Specifications and prices are subject to change without prior notice.

**Circle 364 on Inquiry Card (RESELLERS: 365).**



COMPACT DISC

# The Oxford English Dictionary

Second Edition

COMPACT DISC

the history of the language from  
1150 until the present

over half a million headwords  
defined

2.4 million quotations

linguistic origins traced from over  
one thousand languages

*'invaluable for anyone who uses English in their work.'* BYTE

*'a completely wonderful piece of software.'* THE INDEPENDENT

*'Researchers, librarians and writers in all fields will want to own the world's greatest dictionary in CD-ROM format'*

WINDOWS MAGAZINE

*'one of the major technological achievements of the century.'*

ANTHONY BURGESS

The internationally recognized authority on the usage and meaning of English words and phrase from 1150 to the present is now available on compact disc.

Superb search-and-retrieval software allows you to explore the world's most authoritative dictionary of the English language in unprecedented ways.

However you use the Dictionary – as a detailed reference work or for pure enjoyment – the Compact Disc edition releases its

encyclopedic potential, ensuring hours of entertainment and education.

A Windows application for IBM 386 PCs (and full compatibles). Price: £495 (plus VAT and postage).

For your free brochure, or to order, call or write to:  
**Janet Caldwell, at  
Oxford University Press,  
Walton Street, Oxford OX2 6DP  
Tel: 0865 267979,  
Fax: 0865 56646**

**Y**ou can increase productivity by giving users simultaneous access to multiple UNIX applications on a character terminal or PC.

## FacetTerm

### UNIX Windowing For Character Terminals & PCs

#### FacetTerm Features:

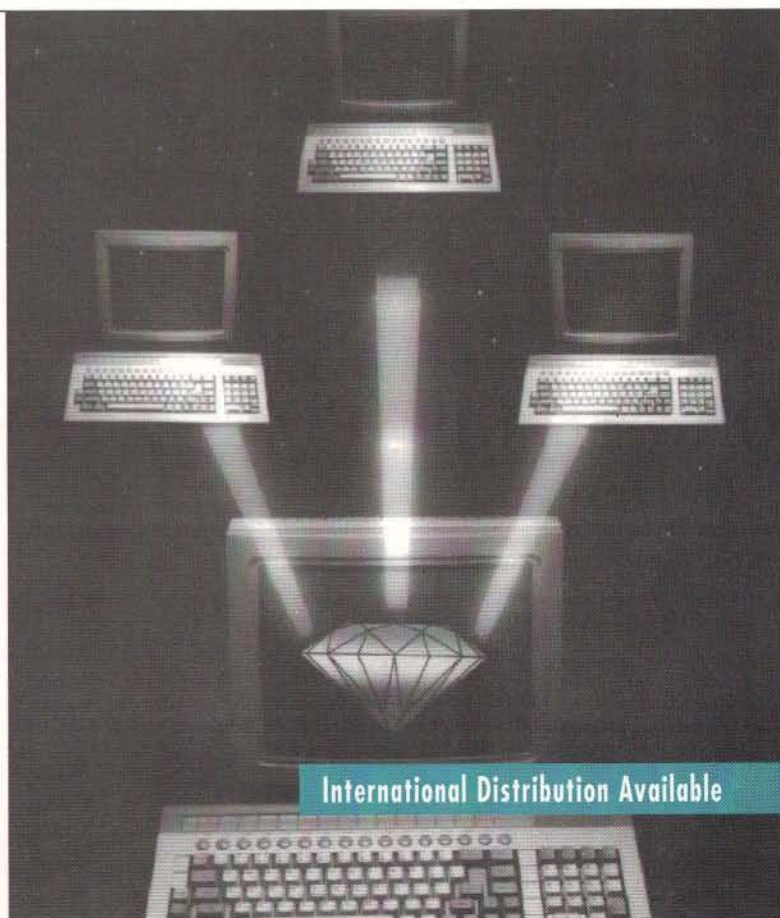
- Multiple, concurrent UNIX sessions for each user.
- Hot key between word processing, DBMS, spreadsheet, 3270 emulation, and any other UNIX application.
- Screen print.
- Cut & paste between applications.
- Pull down menu interface.

**Free Evaluation Program!**  
Full features, documentation and support for 30 days.



**Structured Software  
Solutions, Inc.**

4031 W. Plano Parkway • Suite 205  
Plano, Texas 75093  
214 / 985-9901 • Fax 214 / 612-2035



International Distribution Available



Lemon computers: un marchio ormai da anni protagonista nello scenario informatico.

In un mercato sempre più complesso e competitivo Lemon vi offre la garanzia della sua decennale esperienza.

## ONE RIGHT CONNECTION..



La gamma dei nostri prodotti è in grado di soddisfare qualsiasi esigenza applicativa, sia dal processore 802 fino al veloce 486 con bus EISA. Tutti i modelli hanno un alto grado di affidabilità, grazie anche all'elevato standard qualitativo dei materiali utilizzati.

Qualità di prodotto e qualità globale, che significa "team" di specialisti costantemente al vostro fianco per fornirvi consigli, assistenza tecnica e soluzioni più opportune.

**Lemon computers, the right solution!**

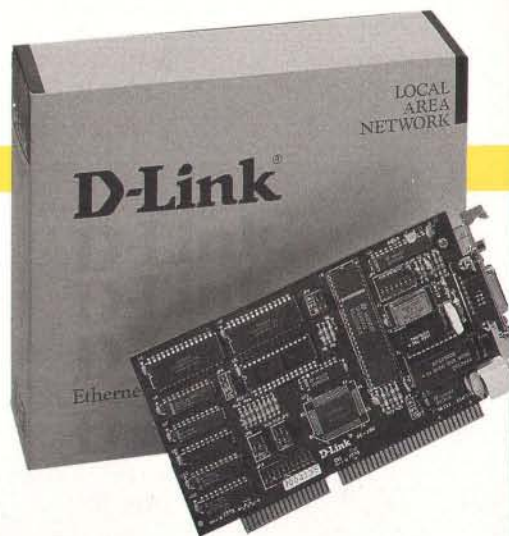
# One & One

D-LINK: una sigla nel mondo del net-working informatico. Un mondo infinito di possibilità si apre di fronte a voi senza dover fare cospicui investimenti.

## ONE BRIGHT CONNECTION

Con JEN e D-LINK non ci sono problemi. Si possono collegare in rete uno o più computers, incrementare la potenza, aggiungere un nuovo computer tutto questo senza difficoltà di installazione. Si possono scegliere tra i vari sistemi operativi LANSMART - NOVELL - UNIX, si aggiungono le schede ed è fatta! Tutto questo dà la possibilità di modulare i propri investimenti in sintonia con le proprie esigenze.

**D-LINK the bright solution!**



JEN ELETTRONICA srl

Zona Ind. E. Fermi - 62010 MONTELUPONE (MC) - Tel. 0733/224012 - Fax 0733/224035  
MILANO - Tel. 02/2138676 - Fax 02/2138831 - Italia

274IS-4 BYTE • OCTOBER 1992

**LEMON**  
computers

**D-Link**

Circle 410 on Inquiry Card



# CREATING BIT-MAPPED BUTTONS

If you're using standard buttons in your Windows programs, you can liven up the interface and make it easier to use by programming bit-mapped buttons. Imagine, for example, a delete icon shaped like a trashcan that opens and closes when you click on it.

To the user, bit-mapped buttons work like standard buttons. However, they're quite different from the programmer's standpoint. To use them, you must draw and load two 16-color bit maps, register a window class, and create a window using `CreateWindow`. *DirManager*, this month's Software Corner selection, uses five bit-mapped button icons that enhance clarity by using pictures instead of words. If implemented properly, bit-mapped buttons can do this for any program.

Standard Windows buttons exhibit common behaviors. When you click on a button in an application, it appears to push down. If you hold down the mouse button while moving the mouse cursor off the button, it pops up again. Move the mouse cursor back onto the button, and the button pushes down. Release the mouse button, and the program initiates an action.

## Bit-mapped window buttons add color and style to your Windows programs

Behind the scenes, the button call-back procedure calls `SetCapture` to capture all mouse input. The button is still receiving mouse messages when the mouse cursor moves outside the button's window.

### Beyond Bit-Mapped Buttons

*DirManager* is more than an exercise in programming bit-mapped 16-color buttons: It's a full-blown public domain File Manager replacement program for Windows. *DirManager* uses bit-mapped icons to perform several functions. Each bit map brings up a corresponding dialog box.

Like File Manager, *DirManager* divides its main window into two sections: A directory appears on the left and files on the right. *DirManager* lets you select one file or multiple files. You can view or execute

selected files, change their attributes, or copy, delete, rename, or move them. Note that *DirManager* launches your viewer or text editor; it does not include its own. To view a file, select it and double-click on the left mouse button. Double-clicking on the right mouse button executes the file.

*DirManager* can rename, create, and delete subdirectories, and it can sort files by name, date, size, or extension in ascending or descending order. Most commands have shortcut keys.

If an error occurs during a file operation, *DirManager* displays a dialog box that lists the error and the files that created it. *DirManager* does not stop a file operation on the first error, but it attempts the specified operation on each selected file. *DirManager* doesn't reread the directory after an error occurs, so the file remains selected. As a result, files shown in the file window may not actually exist in the selected directory. ■

*James Stading is a software developer for Windows in Rockford, Illinois. You can reach him on BIX c/o "editors" or on CompuServe at 71035,3150.*

## MAC/Tom Thompson

### NCSA Telnet for Macs

Oddly enough, there are occasions where I use Unix. Now, thanks to NCSA Telnet 2.5, I can use Unix from a Mac. NCSA Telnet is a public domain Mac application that establishes one or more interactive terminal sessions with Unix workstations via the TCP/IP telnet protocol.

NCSA Telnet runs on top of several flavors of TCP, but I recommend using the MacTCP version so you can work on remote Unix hosts while maintaining normal Mac file-sharing and printing services. NCSA Telnet supports graphics terminal emulation, and it includes ftp for file transfer. I've used NCSA Telnet from my Mac IIci running System 7.0 and MacTCP 1.1 to read mail on the Internet and to work remotely on the Silicon Graphics and Next workstations here at BYTE. NCSA stands for the National Center for Supercomputing Applications (at the University of Illinois), which developed NCSA Telnet 2.5 in coordination with Brigham Young University.

## UNIX/Ben Smith

### Stand-Alone Dired

If you use an emacs editor, you're familiar with its `dired` command, which is a visual method of applying commands to files and directories. Thanks to Mike Lijewski, who is the author of a stand-alone public domain Dired utility, you can now have the ease of the `dired` command without the overhead of emacs.

Dired presents a screen that looks like the output from `ls -l`. If you press the `e` or `f` key when the cursor is on a file, Dired loads the file into your editor. If the cursor is on a directory, you move to that directory. In this way, you can navigate a directory tree. Dired also has commands for deleting, renaming, changing ownership and permissions, page-at-a-time viewing, printing, and searching for strings within the directory list.

Dired is written in C++ and is somewhat tricky to port. It's been tested on many Hewlett-Packard systems, as well as on SunOS, GNU C++, and AT&T C++ systems and compilers.

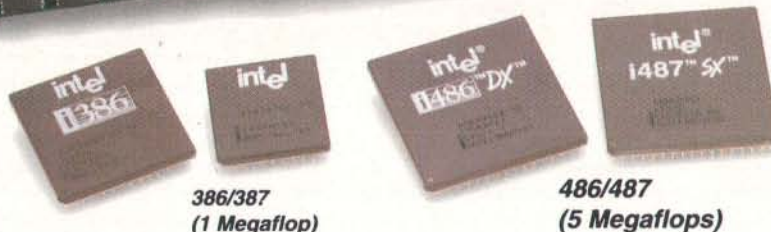
Editor's note: *Software Corner* highlights public domain, freeware, and shareware programs. The programs are available in electronic format. See "Program Listings" on page 5 for details. We solicit your contributions. We pay \$50 for any program we use. Write to: Software Corner, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.



# NDP™ Fortran Drives Them All...



**QuadPuter®-860**  
(200 Megaflops)



**386/387**  
(1 Megaflop)

**486/487**  
(5 Megaflops)



**Extended DOS • OS/2 • NT • UNIX V.3/4 • Solaris • Coherent**

NDP Fortran has been the leading 32-bit PC Fortran since its introduction in 1987. It produces the highest quality numeric code and supports virtually all x86 operating systems, processors and numeric devices. These are just a few of the reasons it was used by hundreds of ISVs to port their 3090, VAX and Cray codes to the 386. NDP Fortran is required to run packages from IBM, Aspen Technologies and Fluid Dynamics. IBM chose it to port their Optimization Subroutine Library to DOS and more recently OS/2. Aspen Plus, the world's leading thermo/chemical-process control software package, is the standard employed by corporations like DuPont. Every copy of Aspen Plus for the PC ships with NDP Fortran-486!

One reason NDP Fortran is still the 32-bit leader is tools. It runs with native tools on UNIX, OS/2 and NT. For DOS, Microway created 32-bit tools that were tuned to the needs of our customers. These include efficient demand paged virtual memory for our Extender and a linker that could handle a 20-megabyte library without going to sleep. We are the only vendor that provides a variety of numeric runtime libraries that make it possible to tune speed against

precision and error recovery. The correct choice of a library vs inline intrinsics can result in a factor of three increase in speed for some applications. Then there is the issue of numeric code quality. NDP compilers are not only globally optimized, but take good advantage of the Intel 387/487 stack, use advanced numeric optimizations and schedule instructions - all of which favor fast numeric and RISC devices like the 860 and 586.

Finally, Microway customizes its compilers to the environment. Our DOS 386/486 product includes over 1,000 pages of documentation, 300 of which are devoted to our GREX™ graphics extensions. The 200 megaflops of our QuadPuter-860 are optimally harnessed using NDP Fortran-860, libraries from IMSL, NAG and KAP and the PSR Vectorizer. Microway can build you a gigaflop NFS computational server using five QuadPuters housed in our industrial grade 486-B3 for just \$50K - massive power without massive price. **If you plan to use a 386, 486, 586 or 860 and require portability, numeric speed, precision and technical support, then NDP Fortran, C/C++ or Pascal is the only solution.**

## Microway®

The Intel Inside Logo, Intel, 286, 386, 387, 486, 487, 586 and 860 are trademarks of Intel Corporation. Microway and QuadPuter are registered trademarks of Microway, Inc.

**Technology You Can Count On**

Corporate Headquarters, Research Park, Box 79, Kingston, MA 02364 USA • TEL 508-746-7341 • FAX 508-746-4678  
Kingston-Upon-Thames, U.K. 081-541-5466 • Germany 069-752023 • Greece 30 12915672 • Japan 047 423 1322 • Poland 22-41004

Circle 133 on Inquiry Card.



# OS/2 2.0 PROGRAMMING TOOLS ARRIVE—FINALLY

**N**ow that IBM has released OS/2 2.0, development tools are beginning to emerge. The 32-bit version 2.0 runs almost every program available for DOS, Windows, and OS/2. Except for a few installation bugs, OS/2 2.0 works well. It's fast and easy to use, and it offers a wide range of configuration options never before supported. Best of all, developers have all the tools they need.

## Early Beta Versions

IBM realized early on that it had to provide development tools for OS/2 2.0. Only 16-bit tools were available, and IBM's only C compiler, C/2, was based on an obsolete version of the Microsoft C compiler. While the IBM C compiler was being developed, IBM released beta versions of it, along with a debugger and development environment called WorkFrame/2.

For professional developers, the OS/2 2.0 beta program was a nightmare. The toolkit releases lagged behind the operating-system releases, so developing software with the latest beta release of the tools meant using an obsolete version of the operating system. The documentation with the beta toolkits was full of errors and omissions, and some manuals had references to obsolete OS/2 1.x functions. IBM was beating the 32-bit drum, but it was incapable of providing developers with timely releases of the tools necessary to develop new 32-bit applications.

IBM kept everyone informed through mailings and CompuServe's OS2DEV and IBMOS2 conferences. The company made no attempt to disguise or hide problems with the beta version and required no confidential disclosures to obtain the code. This was a refreshing change that went a long way toward reestablishing IBM's credibility with developers.

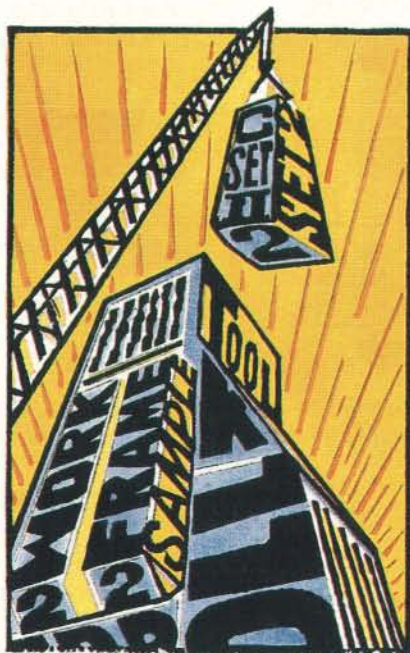
## The First Steps

A few months after IBM released the OS/2 2.0 General Availability (GA) code, it be-

gan shipping version 1.0 of its 32-bit C compiler, C Set/2, as part of the IBM C Developer's WorkSet/2. Included in WorkSet/2 are the Presentation Manager debugger (IPMD), the WorkFrame/2 development environment, the kernel debugger (KDB), sample DLLs, the PMSpy program, the resource compiler, include files, migration tools, and many well-written source code examples.

WorkFrame/2 is a plug-in environment that lets you specify the compiler, assembler, debugger, and linker you will use. It lets you set the compile, link, or debug options to any value you want. It can generate make files and libraries. You can configure it through a simple user window. WorkFrame/2 works with projects rather

**Numerous OS/2 2.0  
development tools are  
finally starting to appear**



than individual files and directories.

You establish a project by entering the project parameters in the Project Control window. You can enter information such as the project name, project description, name of the make files, and compile/link/run options. Once you've entered the information about the project, you can build a new version of the target code by clicking on the "new" button in the Project Control window.

C Set/2 is a full 32-bit ANSI 1989 optimizing compiler that generates code for OS/2 2.0. The compiler supports 16- and 32-bit run-time coexistence, static and dynamic run-time libraries, HPFS (High Performance File System), and memory-mapped file I/O. It provides migration support for converting programs from OS/2 1.x to OS/2 2.0. C Set/2 produces tight, fast, and consistent code. It can't be used to develop virtual or physical device drivers, but C Set/2 is perfect for developing 32-bit applications.

The WorkSet/2's IPMD makes debugging 32-bit applications a breeze. However, the WorkSet/2's initial price of \$895 turned off developers. Developers complained loudly, and IBM dropped the price to \$295 until September 1. It wasn't clear at press time if IBM would extend this policy.

## Support Your Local ISV

IBM has also taken steps to do a better job of supporting ISVs (independent software vendors), who are critical to OS/2 2.0's success. IBM technical-support personnel have appeared on all major BBSes and conferencing systems, including CompuServe, BIX, Usenet, and Fidonet.

Several other OS/2 2.0 support programs are in place as well. The Developer Assistance Program ((407) 982-6408) helps commercial developers. IBM has a toll-free order line ((800) 342-6672) for OS/2 software and support material, and the IBM I.V. League supports authors and publishers. IBM is sponsoring several OS/2



2.0 tools conferences, where developers can get the most up-to-date information on OS/2 2.0 and associated development tools, and OS/2 migration workshops, where developers can get technical assistance in converting their applications to run under OS/2 2.0.

### The Coming Onslaught

Some vendors began developing OS/2 2.0 tools before the GA code was released. Other vendors, noting the overwhelming response to OS/2 2.0, have announced products or plan to release products for OS/2 2.0 later this year. Current offerings include languages, CASE tools, debuggers, and other tools.

In the language area, C and C++ compilers for OS/2 2.0 have been announced by Borland International, Clarion Software, MicroWay, Symantec, and Watcom.

Watcom also has a 32-bit FORTRAN compiler, and Clarion has announced OS/2 2.0 versions of its Pascal and Modula-2 compilers. IBM is rumored to be working on its own C++ compiler, while Arity is shipping a 32-bit Prolog compiler for OS/2 2.0. Digitalk has released an OS/2 2.0 version of Smalltalk/V PM. Micro Focus and Liant Software have announced COBOL compilers for OS/2 2.0.

New CASE tools for OS/2 2.0 PM development have been announced by Caseworks, the Stirling Group, Guild Products, Guidance Technologies, Gpf Systems, VZ, Vleermuis Software Research, Software Engineering International, Enfin Software, ImageSoft, and Intelligent Environments. If you're migrating Windows applications to OS/2, check out Micrografx's Software Migration Kit.

I doubt that you'll need more debug-

ging tools than the ones IBM provides. However, you might want to consider Periscope's OS/2 2.0 version of the Periscope debugger and Soft & GUI's Error Manager debugging tool. SourceLine Software is shipping a hypertext source code browser for OS/2 2.0. Personal Systems Software sells a C-callable toolkit for writing OS/2 2.0 device drivers. Intersolv has announced OS/2 2.0 versions of PVCS, PolyMake, PolyAwk, and the Sage Professional Editor. Hamilton Laboratories has a 32-bit version of its C shell. Gamma-Tech has a 32-bit version of its HPFS utilities. And Parallel PC's is shipping an OS/2 2.0 version of the Synectics SDK (Software Development Kit).

For those on a budget, several good public domain and shareware tools are available for OS/2 2.0. The public domain GNU C/C++ compiler for OS/2 2.0 is available

## COMPANY INFORMATION

### Arity Corp.

(Prolog/32)  
(508) 371-1243

**Circle 1155 on Inquiry Card.**

### Borland International, Inc.

(C++ for OS/2 2.0)  
(408) 438-8400

**Circle 1156 on Inquiry Card.**

### Caseworks, Inc.

(CASE:PM 2.2, CASE:PM  
VIP (CUA 91))  
(404) 399-6236

**Circle 1157 on Inquiry Card.**

### Clarion Software, Inc.

(TopSpeed C, C++, Modula-  
2, Pascal)  
(305) 785-4555

**Circle 1158 on Inquiry Card.**

### Digitalk, Inc.

(Smalltalk/V PM)  
(310) 645-1082

**Circle 1159 on Inquiry Card.**

### Enfin Software Corp.

(Enfin/2)  
(619) 549-6606

**Circle 1160 on Inquiry Card.**

### GammaTech

(GammaTech Utilities)  
(405) 359-1219

**Circle 1161 on Inquiry Card.**

### Gpf Systems, Inc.

(Gpf 2.0)  
(203) 873-3300

**Circle 1162 on Inquiry Card.**

### Guidance Technologies, Inc.

(Choreographer)  
(412) 231-1300

**Circle 1163 on Inquiry Card.**

### Guild Products, Inc.

(Guild)  
(415) 593-3200

**Circle 1164 on Inquiry Card.**

### Hamilton Laboratories

(C shell)  
(508) 358-5715

**Circle 1165 on Inquiry Card.**

### ImageSoft, Inc.

(CommonView)  
(516) 767-2233

**Circle 1166 on Inquiry Card.**

### Intelligent Environments, Inc.

(AM (Applications  
Manager))  
(508) 640-1080

**Circle 1167 on Inquiry Card.**

### Intersolv

(PVCS, PolyMake,  
PolyAwk)  
(503) 645-1150

**Circle 1168 on Inquiry Card.**

### Liant Software Corp.

(RM/COBOL-85)  
(512) 343-1010

**Circle 1169 on Inquiry Card.**

### Micro Focus, Inc.

(Micro Focus/2 COBOL)  
(415) 856-4161

**Circle 1170 on Inquiry Card.**

### Micrografx, Inc.

(Software Migration Kit)  
(214) 234-1769

**Circle 1171 on Inquiry Card.**

### MicroWay, Inc.

(NDP FORTRAN 386/486,  
C-C++ NDP 386/486)  
(508) 746-7341

**Circle 1172 on Inquiry Card.**

### Parallel PC's

(Synectics SDK)  
(215) 670-1710

**Circle 1173 on Inquiry Card.**

### The Periscope Co., Inc.

(Periscope/32)  
(404) 875-8080

**Circle 1174 on Inquiry Card.**

### Personal Systems Software, Inc.

(C-Callable DevHlp Driver  
Library)  
(203) 242-8711

**Circle 1175 on Inquiry Card.**

### Soft & GUI, Inc.

(Error Manager)  
(718) 769-8017

**Circle 1176 on Inquiry Card.**

### Software Engineering International

(Primary Window Class)  
(407) 241-3428

**Circle 1177 on Inquiry Card.**

### SourceLine Software

(SourceLink)  
(619) 587-4713

**Circle 1178 on Inquiry Card.**

### The Stirling Group

(TbxShield, InstallShield)  
(708) 307-9197

**Circle 1179 on Inquiry Card.**

### Vleermuis Software Research

(GUI Master)  
fax: 31-30-32-49-44

**Circle 1180 on Inquiry Card.**

### VZ Corp.

(VZ Programmer)  
(801) 595-1352

**Circle 1181 on Inquiry Card.**

### Watcom

(C 9.0/386, FORTRAN  
77/386 9.0)  
(519) 886-3700

**Circle 1182 on Inquiry Card.**



**IF YOU READ THIS AD,  
THEN YOU'RE ONE OF  
BYTE'S 500,000 READERS  
WHO IS:**

- **INFLUENTIAL**
- **AUTHORITATIVE**
- **TECHNICALLY-ADVANCED**
- **KNOWLEDGEABLE**
- **INNOVATIVE**



**AND MOST OF ALL . . . BUSY!**

When you want to buy, turn to the **BYTE Buyer's Guide** in the back for fast access to buying direct from reputable suppliers. From computers to CAD, notebooks to networks, memory to mathematics, you'll find it in the **BYTE Buyer's Guide**.

**Tell 'em you saw it in BYTE!**



1	Exxon
2	General Motors
3	Mobil
4	Ford Motor
5	IBM
6	Texaco
7	E.I. du Pont
8	Standard Oil (Ind.)
9	Standard Oil of Cal.
10	General Electric
11	Gulf Oil
12	Atlantic Richfield
13	Shell Oil
14	Occidental Petroleum
15	U.S. Steel
16	Phillips Petroleum
17	Sun
18	United Technologies
19	Tenneco
20	ITT
21	Chrysler
22	Procter & Gamble
23	R.J. Reynolds Ind.
24	Getty Oil

25	Standard Oil (Ohio)
26	AT&T Technologies
27	Boeing
28	Dow Chemical
29	Allied
30	Eastman Kodak
31	Unocal
32	Goodyear
33	Dart & Kraft
34	Westinghouse Elec.
35	Philip Morris
36	Beatrice Foods
37	Union Carbide
38	Xerox
39	Amerada Hess
40	Union Pacific
41	General Foods
42	McDonnell Douglas
43	Rockwell Int.
44	PepsiCo
45	Ashland Oil
46	General Dynamics
47	3M
48	Coca-Cola

49	Consolidated Foods
50	Lockheed
51	Georgia-Pacific
52	Monsanto
53	W.R. Grace
54	Signal Companies
55	Anheuser-Busch
56	Nabisco Brands
57	Johnson & Johnson
58	Coastal
59	Raytheon
60	Honeywell
61	Charter
62	General Mills
63	TRW
64	Caterpillar Tractor
65	Aluminum Co. of Amer.
66	Sperry
67	Gulf & Western Ind.
68	Continental Group
69	Bethlehem Steel
70	Weyerhaeuser
71	Ralston Purina
72	Colgate-Palmolive

## HANDS ON/BEYOND DOS

on BIX, CompuServe, and other BBSes. You can also download several GNU utilities (e.g., rcs, make, awk, grep, and diff) and the GNU emacs editor.

### The Written Word

IBM has announced the OS/2 Technical Library, a set of manuals for OS/2 developers that's priced at \$295. The manuals are a necessity for anyone programming for OS/2 2.0. For an in-depth technical overview of OS/2, get *The Design of OS/2* by H. M. Deitel and M. S. Kogan (ISBN 0-201-54889-5) from Addison-Wesley.

Van Nostrand Reinhold has published several new books, including *Client-Serv-er Programming with OS/2 2.0* by Robert Orfali and Daniel Harkey (ISBN 0-442-01219-5), *Writing OS/2 2.0 Device Drivers in C* by Steve Mastrianni (ISBN 0-442-01141-5), and *OS/2 Presentation Manager GPI* by Graham Winn (ISBN 0-442-00739-6). Van Nostrand also offers a library of six books at a special price.

### The Timing Is Right

Interest in OS/2 2.0 is growing by leaps and bounds. Even its most stubborn opponents have been impressed with its capabilities. The old OS/2 1.x supporters are still around, and they have been joined by an even larger group of users and developers eager to tap the multitasking and multiplatform support offered by OS/2 2.0.

IBM's aggressive pricing has prompted many Windows users to upgrade to OS/2 2.0 for only \$49.95; DOS users can upgrade for only \$99. Interest in OS/2 2.0 is also evident by the many messages that appear in public electronic conferences.

Have the tools arrived to develop the new-generation 32-bit software for OS/2 2.0? You better believe it. The time is right to begin development. Sure, you'll want to keep some of your DOS and Windows applications around, but you can realize the full power of OS/2 only with new 32-bit OS/2 2.0 applications. As PC users become more demanding, they'll begin to appreciate the power and flexibility of OS/2 2.0. The ability to download a file over the telephone while simultaneously updating a database, printing several files, and editing a document should convince the most skeptical user that OS/2 2.0 represents the best solution for desktop software applications. ■

*Steve Mastrianni is president of Personal Systems Software in Bloomfield, Connecticut. He specializes in device drivers, operating systems, and real-time applications for OS/2 and Windows NT. You can reach him on BIX as "smastrianni" or on CompuServe at 71501,1652.*

## 27 million Americans can't read. And guess who pays the price.

While American business is trying to stay competitive with foreign companies, it's paying an added penalty. The penalty of double-digit illiteracy.

Believe it or not, 27 million American adults can't read and write. Another 47 million are literate on only the most minimal level. That adds up to almost one third of our entire population... and probably a disturbing number of your employees.

What does illiteracy cost you? Get out your calculator. Illiterate adults make up 50%-75% of our unemployed. Every year they cost us an estimated \$237 billion in lost earnings. They swell our welfare costs by \$6 billion annually and diminish our tax revenues by \$8 billion.

Illiteracy costs you through your community, too. It robs the place where you work and live of its resources. It undermines the potential of the people who make your products and the people who buy them. No dollar figure can be assigned to this. But over the years, this may be the costliest loss of all.

What can your company do about this? It can join in local efforts to fight illiteracy. It can volunteer company dollars and facilities for better school and tutorial programs. It can invest in a more literate community.

The first step is to call the Coalition for Literacy at 1-800-228-8813 or fill out the coupon below. Do it today. You may find it's the greatest cost-saving measure your company has ever taken.

**A literate  
America  
is a good  
investment.**



Coalition for Literacy

☐ I want my company to join the fight against illiteracy. Please send brochure with additional information.

☐ We want to discuss funding the Coalition for Literacy. Please have a representative contact me.

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_

Please return to: Coalition for Literacy  
Business Division  
P.O. Box 81826  
Lincoln, NE 68501-1826



# COPY SOFTWARE ILLEGALLY AND YOU COULD GET THIS HARDWARE ABSOLUTELY FREE.



Software piracy isn't just a crime. It's a shame. Because most people who do it aren't even aware that it's illegal. If you copy software that's protected by copyright, you could lose your job, face a civil suit, pay a \$100,000

fine and possibly be imprisoned. So get the facts now. To request more information, contact the Software Publishers Association at 1-800-388-7478. Because in a court of law, ignorance is one thing you won't be able to plead.

Please send me more information on the legal use of software.	
Name _____	
Organization _____	
Title _____	
Address _____	
City _____ State _____ Zip _____	
Please check software format you prefer if you would like to receive SPAudit, a software inventory management tool.	
____ DOS 3.1* ____ DOS 5.2* ____ Macintosh*	
Mail to: Piracy Update, 1730 M Street, N.W., Suite 700, Washington, D.C. 20036-4510	
	H-1



## Don't Copy That Floppy



# ASK BYTE

## File Convenience

I'll soon be getting a 486 computer. I do not look forward to reinstalling all my software, especially since I've customized most of my programs for the way I work. Can I use a file transfer utility to port over my program files to the new machine?

Monte Smith  
Burley, ID



*Moving all your files to the new machine using a file transfer application is a simple and quick method for getting your new machine up and running. Although you probably won't encounter any problems, several issues should concern you.*

*If you are transferring files from a 386SX or 386DX computer, you shouldn't have any problems. If you are moving from a 286 or 8088 machine, however, you may not be taking full advantage of some of your applications' capabilities.*

*Some applications determine your machine's configuration at installation time and install only the code for that processor. Although these programs will still run on the 386 or 486, you will not be getting the full advantage of a more sophisticated processor.*

*If you transfer applications from several logical drives to one larger drive on the new machine, you may need to run a setup utility to ensure that any internally maintained paths are updated to your new configuration. Once the files are transferred, you may want to run a file checksum program to ensure that the new files perfectly match the old ones. Checksum programs are available on many BBSes. Many antiviral applications also have checksum capability.*

*Make sure you don't transfer your copy of DOS from the old machine. This is very easy to do, and it may lead to some rather obscure and difficult-to-diagnose bugs. Finally, if you're moving Windows and you're not using the generic VGA driver, you'll have to run the Windows setup program and install the appropriate video driver before running Windows on your new machine.*

—Raymond GA Côté

## Bus Bust

I just bought a 1200-bps modem for \$49. When I plug it into my 12-MHz 286, I have to turn off the turbo mode before the modem will work. Why do I have to do this? My other 8-bit interface cards work fine. My computer has a generic motherboard that has no documentation.

Charlie Merritt  
West Fork, AR

*Your turbo switch probably changes the I/O bus speed as well as the processor speed. Modern motherboard I/O buses run at 8 and 10 MHz. Considering the price of the modem, it may be designed for operation only at 8 MHz, thus requiring you to turn off your turbo mode. Check the modem's documentation for recommended speeds.*

—Raymond GA Côté

## FTP Wanted

While reading the July BYTE, I was pleased to note that you have an Internet address. Is this address merely for correspondence, or does it contain an archive of some of your test programs that you use to do your benchmarks?

Matthew Hogan  
s892983@minyos.xx.mit.edu

I'm glad to see that you are on the Internet. Are you willing to answer technical questions over this network as you do when getting snail mail?

Klaus Hahn  
Braunschweig, Germany

*Yes, you can use Internet E-mail to reach BYTE editors. The name of BYTE's system is bytepb.byte.com. Our main connection for E-mail is through the most connected computer in the world, UUNET, in Falls Church, Virginia. We rely on UUNET for archived files and the source code to many of the Unix programs that we have written about in the Software Corner column.*

*Not all BYTE editors have accounts on bytepb, so address your letters to letters@bytepb.byte.com. Queries to specific authors or editors will be forwarded.*

*Address technical questions to askbyte@bytepb.byte.com. We'll try to answer your questions, but due to the volume of mail received, we can't guarantee a personal reply.*

*We do not currently make source code available via the Internet, but we're considering several options for doing so. One option is to establish a file transfer protocol connection to the network; another is to set up a mail server. Mail servers are less expensive and simpler. They also let users who don't have direct Internet access retrieve files. On the downside, sources must be broken into small files so they can move as mail messages, and there is an increased burden on intermediate sites in the mail path.*

—Ben Smith, ben@bytepb.byte.com

## Feeling Compressed

I just downloaded a compressed file of type .LZH. What utility should I use to decompress this file? I tried PKUnzip to no avail.

William O'Brien  
Vienna, VA

*You need LHA213.EXE, a free compression and archiving utility you'll find in the ibm.utils listings area on BIX and on many BBSes. LHA has a dual purpose. It's primarily designed to take normal executable or text files and make them smaller in size. This saves a great amount of storage space; typical files reduce to one-quarter to one-third of their original size. You can compress text files more than you can executable files.*

*LHA can also combine several files into one .LZH archive file. This lets you store complete hard disk directories in a single filename, and in a space typically one-half or less the original total. Putting many files into a*



single compressed archive file makes distribution easier.

You'll find a wide variety of file-compression programs on BBSes and conferencing systems. Each creates its own file extension (e.g., .ARC, .DWC, .LZH, .PAK, .ZIP, and .ZOO). Each also has its own unique characteristics and compression format. Not all compression utilities are free, but most companies offer free decompression utilities. See the table for a listing of decompression utilities available in the *ibm.utils* listings area on BIX.

—Stan Wszola

#### BIX DECOMPRESSION UTILITIES

Extensions for most compressed files, the decompression utility to use, and the filename of each decompression utility in the *ibm.utils* listings area on BIX.

Extension	Utility	Filename
ARC	PKUNPAK.EXE	pk361.exe
ARJ	ARJ.EXE	arj230.exe
LZH	LHA.EXE	lha213.exe
PAK	PAK.EXE	pak251.zip
SDN	PAK.EXE	pak251.zip
SIT	UNSIT.EXE	unsit30.zip
TAZ	UNCOMPRESS.EXE	compr343.zip
ZIP	PKUNZIP.EXE	pkz110.exe
ZOO	ZOO.EXE	zoo210.zip

#### Necessary Literature

My daughter wants to buy a computer, and we need documentation that is detailed. I understand that the documentation with some computers is so meager as to be nothing more than a collection of component documents. With other machines, the documentation includes a detailed and complete exposition of the machine in toto. Has BYTE published any articles evaluating the quality and quantity of the documentation supplied by various vendors?

Howard E. Mayberry Jr.  
Louisville, KY

In my long tenure at BYTE, I have never seen a review of computer systems based on the quality of the documentation. That would certainly be an interesting criterion for selecting a computer.

I've seen many computers and read a lot of documentation, but I'd be hard-pressed to pick the best company based on its manuals. The best advice I can give is that you purchase your computer from a major vendor. Check the ads in BYTE, and make a purchase from companies that are well established. Companies like Compaq, Northgate, Gateway 2000, and Dell have been successful because they pay attention to details like good documentation.—Stan Wszola

#### Installer's Tip

At BYTE, I often use a contact enhancer called Stabilant 22 when performing maintenance on computer

equipment. Stabilant 22 is a block polymer liquid that you apply as a thin film onto electrical contacts. It acts as a contact enhancer and corrosion inhibitor.

Stabilant 22 has another property—lubrication—that I didn't fully appreciate until I did extensive work with a variety of PGA (pin-grid array) chips. Installing a PGA chip (e.g., a 387DX math coprocessor) requires enough force that you may mash the pins or bend the motherboard and break some of the traces. Even with industrial-quality extraction tools, it's easy to reduce a \$200 chip to a paperweight.

Stabilant 22 reduces the force required to insert and extract a chip from its socket. It is also effective for DIP chips and leadless chip sockets. A half-ounce bottle of concentrated Stabilant 22 sells for \$68.50. It's available from D.W. Electrochemicals, Ltd., 97 Newkirk Rd. N, Unit 3, Richmond Hill, Ontario, Canada L4C 3G4, (416) 508-7500.—Stan Wszola

#### Next Monitor

I used an Eizo 21-inch monochrome monitor on my previous system. I plan to buy a monochrome Nextstation and would like to use the Eizo monitor. It is in many respects superior to the 17-inch Nextstation monitor. Is this possible?

I guess I'll have to connect the keyboard and mouse to the Nextstation via a sound box and make a special cable for the video signals. I assume this is more or less how things work with a Nextcube and a Nextdimension board. I don't mind doing some hardware work myself, but I want to be sure this is possible before investing too much money in such an experiment.

Andreas Muller  
Bures-sur-Yvette, France

The Nextstation monitor has a 100-Hz video bandwidth and a 68.3-Hz vertical refresh. The pin-outs for the D-19 plug are as follows:

1	+12 V	11	+12 V
2	-12 V	12	-12 V
3	Monitor clock	13	Ground
4	Monitor data out	14	Ground
5	Monitor data in	15	Ground
6	Monitor power switch	16	Ground
7	Not used	17	Ground
8	Vertical sync	18	Ground
9	Horizontal sync	19	Ground
10	Video signal		

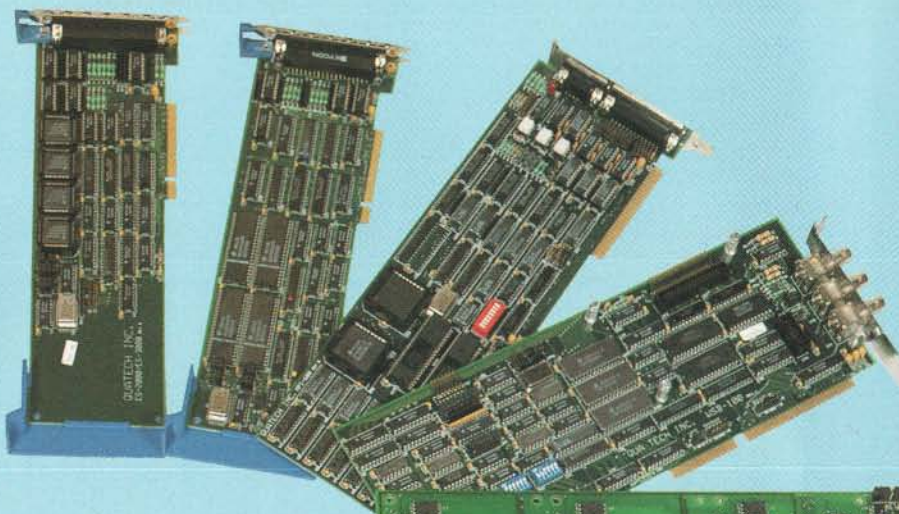
This should be enough information for you to at least decide if it will be feasible to use your Eizo monitor. Unfortunately, I was unable to find any data on your monitor.—Ben Smith ■

The BYTE Lab welcomes your questions. Address correspondence to Ask BYTE, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. You can also send BIX mail c/o "editors."

We read every letter, but due to the volume of mail received, we cannot guarantee a response. We edit all letters for clarity and brevity.



# WHEN YOU NEED SOLUTIONS, NOT JUST ANOTHER BOARD!



Let a Quatech Sales Engineer show you the value of quality, service and support.

## COMMUNICATION

Quatech produces a full line of serial and parallel adapters for PS/2, PC-XT, AT and compatible systems available in RS-232, RS-422, RS-485 and Current Loop. Selectable addresses and interrupt capabilities are featured in our multi-port/user, SDLC, HDLC, and X.25 adapters. Software and 16550 UARTS are available.



## DATA ACQUISITION

Quatech has developed a full line of data acquisition products for the IBM AT and compatibles. These high performance, low cost boards provide analog-to-digital, digital-to-analog, and digital input/output functions. A/D and D/A converters are equipped with 8, 12, or 16 bit resolution, and sampling rates up to 1 MHz.

# 1-800-553-1170



Made  
in  
U.S.A.

Corporate office: (216) 434-3154, FAX (216) 434-1409, 662 Wolf Ledges Pkwy, Akron, OH 44311 U.S.A. International: Australia/Interworld Electronics 03-563-7066, Canada (Western)/Interworld VCR 604-984-4171, England/Diamond Point International 634-722-390, Finland/Lab Hitech OY 358-0-804-2522, France/Elexo 33-1-69302880, Germany/Jupiter Electronic Systems 06181/75041, Israel/RCM Ltd. 972-03-5447885, Italy/N.C.S. Computer Italia 0331/ 770-016, Netherlands/ACAL Auriema 040-816565 Korea/Sam Boo Enterprise Co. 02-678-7457. IBM PC-XT, AT and PS/2 are registered trademarks of IBM Corp.



# *Buy it Through* **BYTE**

## BUYER'S GUIDE

### Mail Order

The latest offerings from vendors supplying products of all leading manufacturers at extremely competitive prices.

**286**

### Hardware/Software Showcase

This categorized four-color display section makes it easy to find Hardware and Software products from a wide variety of manufacturers and suppliers.

**324**

### Buyer's Mart

From Accessories to Laptops to Word Processors, you can easily find the dealers you are looking for in this directory of products and services.

**333**

**BYTE**



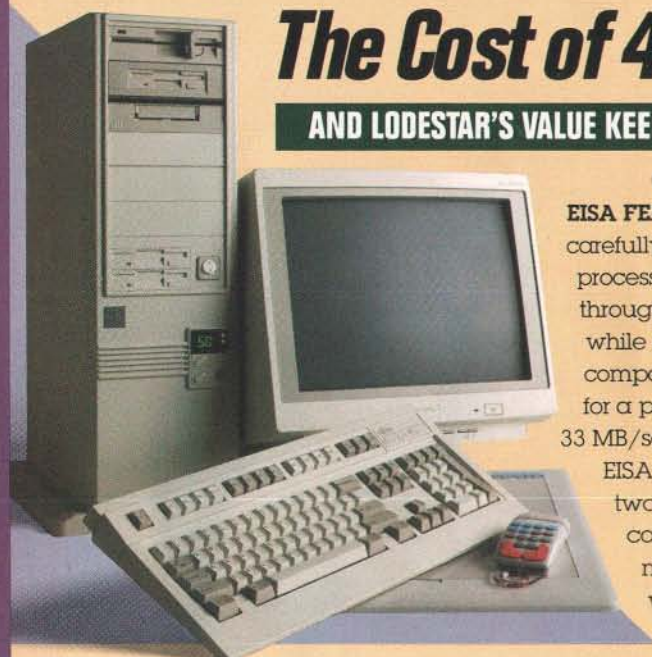
# The Cost of 486 Power is Falling Fast.

**AND LODESTAR'S VALUE KEEPS GOING UP:**

**CONSIDER THESE EISA FEATURES:** We've carefully designed a 32-bit processing solution that breaks through the ISA bottleneck while maintaining downward compatibility with a 16-bit Bus for a peak data transfer rate of 33 MB/sec. Six, true, fully blown EISA Bus Mastering slots plus two EISA slave slots so you can be assured your EISA mastering add-on cards will work for you (typical 8 slave slots won't).

LODESTAR's bus mastering, intelligent expansion cards with their own I/O processors operating in parallel with the main CPU, frees up your load on the CPU. Bus throughput is improved by implementing direct memory access (DMA) and bus masters.

Its speedy performance capability provides you with an ideal solution for a wide range of demanding applications, like CAD/CAM/CAE, formidable database management, image processing, artificial intelligence, desktop publishing and in the environments of network and multiuser systems.



**NOW \$1349**

## 486-SX Workstation 486-SX/20

- 4MB fast RAM expandable to 32MB
- 85MB 15ms IDE hard drive w/cache
- 1:1 interleave 2H/2F IDE controller
- 1.2MB 5.25" & 1.44MB 3.5" floppy drives
- 16-bit 1024x768 SVGA card w/1MB RAM
- 14" 1024x768 0.28mm dot pitch SVGA color monitor
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0 & MS Windows 3.1
- Enhanced 101-key keyboard
- High resolution serial mouse
- Desktop case

**486-SX/25 \$1389**

**NOW \$1639**

## 486 ISA Dataquest 486/33

- 64K ultrafast write-back cache SRAM
- 4MB fast RAM expandable to 32MB
- 130MB 15ms IDE hard drive w/64K cache
- Teac 1.2MB 5.25" & 1.44MB 3.5" floppy drives
- 16-bit 1024x768 SVGA card w/1MB RAM
- 14" SVGA 1024 non-interlaced 0.28mm dot pitch color monitor. VESA 72Hz flicker-free display
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0 & MS Windows 3.1
- Enhanced 101-key keyboard
- High resolution serial mouse
- Desktop case

**NOW \$2079**

## 486LB WINstation 486-DX/33

- 2 32-bit Local Bus expansion slots for 32-bit power expandability
- 64K ultrafast write-back cache SRAM
- Built-in 487 math coprocessor & 8K cache in the CPU
- 4MB fast RAM expandable to 32MB
- 130MB 15ms IDE drive w/64K cache
- High throughput Super IDE Caching Controller. Reduces average disk seek time to 0.2ms
- Teac 1.2MB 5.25" & 1.44MB 3.5" drives
- 32-bit Local Bus S3 Graphics Engine w/1MB VRAM. Up to 1280x1024 resolution & 32,768 colors
- 14" 1024x768 non-interlaced 0.28mm dot pitch SVGA monitor. VESA 72Hz flicker-free display
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0, Windows 3.1 & mouse
- Enhanced 101-key keyboard
- Mid-vertical case

**486-DX2/50 \$2219**

**486-DX/50 \$2329**

**486-DX2/66 \$2579**

**NOW \$3039**

## 486 EISA CADstation 486-DX/33

- 256K ultrafast write-back cache SRAM. Provides better hit-rate.
- Built-in 487 math coprocessor & 8K cache in CPU
- 8MB fast RAM
- 213MB 13ms IDE drive w/64K cache
- High throughput Super IDE Caching Controller. Reduces average disk seek time to 0.2ms
- Teac 1.2MB 5.25" & 1.44MB 3.5" drives
- 32-bit SVGA card w/1MB RAM. Up to 1280x1024 resolution & 65,536 colors
- 17" 1280x1024 SVGA non-interlaced color monitor. VESA 72Hz flicker-free display
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0, Windows 3.1 & mouse
- Enhanced 101-key keyboard
- Desktop or mid-vertical case

**486-DX2/50 \$3179**

**486-DX/50 \$3289**

**486-DX2/66 \$3539**

Optional: 17" Viewsonic 7 Monitor

**Some of our most astute customers are buying today, upgrading tomorrow.**

To maximize the useful life of their systems, our customers depend on us. No need for them to unplug an obsolete system. They're using the power they need today and, with their LODESTAR StarFlex Series, they'll be upgrading simply, painlessly. LODESTAR's unique StarFlex CPU sockets are built right into the system. Upgradable all the way from 386DX to 486SX or 486DX, at any clock speed.

They keep coming to us because most other "upgradable" systems require purchase of a special CPU module board. This causes some performance loss due to speed adjustment. And they couldn't rely on those vendors being there when they needed to upgrade. Nor could they rely on sky-rocketing prices. So they've been calling LODESTAR.

**Now Our Customers Are Getting It All—Value, Features and Price.**





# How thousands of our customers are **BUYING DIRECT**

When they buy from us, they're buying directly from the factory. So they get more value with each purchase, and are always assured their system is backed directly by the people who assembled it.

## NOW

**THESE PRICES  
GUARANTEED  
THROUGH  
NOV. 31, 1992**

**NOW \$1099**

### 386-SX Workstation

#### 386-SX/25

- 2MB RAM expandable to 32MB
- 42MB IDE hard drive w/32K cache
- 1:1 interleave 2H/2F IDE controller
- 1 2MB 5.25" & 1 44MB 3.5" floppy drives
- 16-bit 1024x768 SVGA card w/1MB RAM
- 14" 1024x768 0.28mm dot pitch SVGA color monitor
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0 & MS Windows 3.1
- Enhanced 101-key keyboard
- High resolution serial mouse
- Desktop or mini-vertical case

**386-SX/33 \$1139**

**NOW \$1359**

### 386-DX Workstation

#### 386-DX/25

- 4MB RAM expandable to 32MB
- 130MB 15ms IDE hard drive w/64K cache
- 1:1 interleave 2H/2F IDE controller
- 1 2MB 5.25" & 1 44MB 3.5" floppy drives
- 16-bit 1024x768 SVGA card w/1MB RAM
- 14" 1024x768 non-interlaced 0.28mm dot pitch SVGA monitor
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0 & MS Windows 3.1
- Enhanced 101-key keyboard
- High resolution serial mouse
- Desktop or mini-vertical case

**386-DX/33 \$1399**

**386-DX/40 \$1439**

**NOW \$1459**

### StarFlex 3/486C

#### 386-DX/25

- CPU upgradable to 386DX, 486SX, 486DX, 486DX2. Up to 66MHz
- 64K ultrafast write-back cache SRAM expandable to 256K
- 4MB fast RAM expandable to 32MB
- 130MB 15ms IDE drive w/64K cache
- 1 2MB 5.25" & 1 44MB 3.5" drives
- 1MB SVGA non-interlaced color card
- 14" 1024x768 non-interlaced 0.28mm dot pitch SVGA monitor VESA 72Hz flicker-free display
- 2 serial, 1 parallel & 1 game port
- MS DOS 5.0, Windows 3.1 & mouse
- Enhanced 101-key keyboard
- Desktop or mini-vertical case

**386-DX/33 \$1489**

**386-DX/40 \$1519**

**486-DX/33 \$1739**

**486-DX2/50 \$1939**

**486-DX/50 \$2049**

**486-DX2/66 \$2299**

## Your Assurance of Complete Satisfaction

### OUR RISK-FREE GUARANTEE

Look for your comprehensive, written guarantee when you take delivery of any LODESTAR system. This industry-acclaimed, FIVE WAY Personal Warranty proves our willingness to stand behind everything you buy from LODESTAR.

CALL FOR YOUR FREE COPY; we'll fax or mail it immediately. Use the LODESTAR FIVE-WAY GUARANTEE as your shopping guide; compare and question the others before ordering.

# 1-800-875-3818



GOVERNMENT, SCHOOL AND CORPORATE ORDERS WELCOME. TO RECEIVE YOUR FREE COPY OF OUR PRODUCT CATALOG, JUST CALL.

All specifications subject to change without notice. 2-Year Parts Warranty applies to advertised LodeStar systems only. Money Back Guarantee does not include shipping & handling, and all returns must be shipped pre-paid & in reasonable condition. Please call to confirm all warranty details. Photography is for illustration only. No surcharge on VISA, MasterCard & Discover. Purchase orders are accepted on approved credit. California orders add 8.25% sales tax. All product names, trademarks and registered trademarks are the property of their respective companies. © 1992 LodeStar Computer Corp.

Circle 249 on Inquiry Card.



### We Won Again. And you enjoy the benefits.

In their latest survey of QUALITY CONTROL, proven by this nationwide provider of warranty services, LODESTAR again has earned their rating EXCELLENT.

### SHIPMENT WITHIN 48 HOURS

Every system is individually pretested and burned-in for 72 hours prior to shipment.

We have the right system for you. If it's not already configured, we'll customize it.

Systems can be upgraded to include optional cache, RAM, more hard disk capacity, larger monitor and a host of other enhancements.



"YOU MADE US A LEADER."

18539 East Gale Avenue  
City of Industry, California 91748  
Telephone: 1-818-810-3818  
Tech Support: 1-800-875-7569  
Fax: 1-818-810-5928  
Open Hours:  
Mon-Fri: 7am-7pm (PST)  
Sat: 9am-4pm (PST)





After 9 years, We're Still Doggedly  
Determined to Give the Best Doggone  
Service and Prices to PC Users!

1-800-438-6039

## Network

<b>3COM</b>	
3C503 Etherlink II/ 5-pack	189/799
3C503TP 10 Base T	229
3C505B Ethernet Plus	579
3C507 Etherlink 16	279
3C523 MCA Ethernet	269
<b>ARTISOFT</b>	
Starter Kit 2mbps/AE2	325/459
Starter Kit/AE3	539
Lan Card 2mbps/AE2	129/199
Lan Card 5mbps/AE2	229
Central Station	419
<b>NOVELL</b>	
Novell Lite 1.0/starter kit	69/399
Network 2.2 5/10 User	479/1099
Network V.2 2-50 user	1899
Network 3.11 20/100 User	1899/3648
Network 3.11-10 User	1375
NE1000/NE2000	129/155
NE 3200	889
Access Server	1595
<b>SMC</b>	
PC130/PC130E	75/99
PC600WS/PC600FS	129/209
HUB 8-Active/4-Passive	249/69
Ethercard 8 bit/16 bit	149/169
Token Card 8 bit/16 bit	349/399
10 Base-T Card 8 bit/16 bit	185/205
3608TP 10BT concentrator	409
3106 16 bit Ethernet 10BT coax	159
3512TP Ether 10BT conc. 12 port	709
<b>THOMAS CONRAD</b>	
TC4045 16/4 Token Ring	499
TC6151-11 16 port smart hub	679
TC6242/TC6242-TP+	69/99
TC6245/TC6245-TP+	199/219
TC6045/TC6045-TP+	199/219

## Network Software

Borland D Base IV LAN-1 user	249
Borland Quatro Pro V.4.0 ntwkable	319
Close-Up Lan 2user/8 user	249/479
Poxpro Lan 6 user	539
Lotus 2.4 server/node	559/339
Lotus 3.1 server/node	625/409
Norton PC Anywhere V.4.5	119
Norton PC Anywhere V.4.5 Lan	325
Peachtree Network Accounting	489
Procomm Plus Network 5 pack	325
Unouchable Network	429
Word Perfect Office-5 user	289
Wordstar 2000 LAN-3 pack	259
X Tree Virus Safe Lan	379
X Tree Net/ for Unix	319/189

## Software

Aldus Pagemaker	499
Carbon Copy/Close Up	110/109
Clarion ProDeveloper	449
Clipper 5.0	489
Corel Draw	365
Obase IV 1.5	389
Desqview 386	129
Foxbase/FoxPro	195/449
Freelance Plus	309
Harvard Graphics	359
Lotus 2.4/3.1 Plus	345/379
Lotus Symphony	469
Lotus for Windows	415
Smart Suite/Upgrade	449/339
Microsoft Windows 3.1/Word	89/219
Microsoft Word for Windows	319
Microsoft Excel for Windows	299
Norton Desktop for Windows	84
Norton Utilities 6.0	115
Norton AntiVirus	85
Peachtree III Complete DQ	189
Paradox	call
Q&A 4.0	219
Quattro Pro	259
Ventura Desktop Publishing	479
Word Perfect 5.1	255
Word Perfect for Windows	259
Wordstar 7.0/2000+	259/225

## Chips

INTEL 387-33	95
387-SX16/20	89
CYRIX SX16/20/25	77
SX33	95
DX33/40	95/125

## Notebooks

<b>TEXAS INSTRUMENTS</b>	
3000-60/80/120	2025/2195/2589
3000 Win SX-80/80	1995/2339
3000 Win SX/120	2699
<b>TM4000 Win+ 4MB</b>	
SX/16 w/ 80MB HD	2495
SX/25 w/ 120MB HD	2999
DX/25 w/ 120MB HD	3325
<b>LIBREX</b>	
SX/20 + 4 MB w/40HD	1250
SX/20 + 4 MB w/60HD	1325
SX/20 + 4 MB w/80HD	1450
<b>AST 386SX-20</b>	
43V + w/ 40MB +2MB	1995
63V + w/ 60MB + 2MB	2299
<b>NEC</b>	
Ultralite SX20 w/ 80	2539
Ultralite SX20 w/ 80	2599
Ultralite SX25 color w/ 80	4999
<b>EPSON</b>	
NBSL-20/25	1525/1775
w/ 60/80/120 MB HD	389/549/758

## Monitors

<b>NEC MULTISYNC</b>	
3FGX/4FG	689/769
<b>PANASONIC</b>	
1381/1395	329/439
1991-20"1280x1024	1559
<b>SAMSUNG</b>	
Flat White ML4571	119
CVB 4995 Syncmaster 2E	269
CVM 4967 Syncmaster 3E	299
<b>CTX</b>	
5468/5468NI	289/329
3436 Multiscan 28	399
1760 17" VGA 28	815
5439/5432	229/275
<b>NANAO</b>	
9070U/9080i	869/1025
5501/5601	1149/1899
<b>VIEW SONIC</b>	
7/6/6SF	1069/369/629

## Video Cards

<b>ATI</b>	
VGA Integra 512K	89
Graphics Vantage 1mb	349
Graphics Ultra w/ 1MB	459
8514 Ultra Plus w/ 1MB	389
VGA Wonder XL w/ 1mb	189
<b>BOCA</b>	
Basic VGA/Super VGA	63/129
<b>CARDINAL</b>	
VGA 700/732 w/1MB	119/139
900 w/ 1mb/7000	225/169
<b>ORCHID</b>	
Prodesigner II w/ 1 mb	189
Fahrenheit 1280 degree with 1 MB	289
<b>VIDEO SEVEN</b>	
1024i Plus w/ 512	95
V RAM II 1 mb	269
Win. VGA w/ 1 mb	159

## Modems & Fax

<b>CARDINAL</b>	
2400 INT/EXT	62/84
2400 INT/EXT w/MNP	89/99
9600 INT/EXT	249/279
96/24 Fax modem INT	89
<b>HAYES</b>	
Ultra 1.44 V.32	679
Ultra 9600 ext	569
Optima 9600 V.32	349
<b>HEWLETT-PACKARD</b>	
Plain Paper Fax 200/310	999/1339
<b>INTEL</b>	
Satisfaction Modem 200/400	309/409
<b>PRACTICAL PERIPHERALS</b>	
9600 V.42 Int/Ext	269/279
1.44FX fax/modem Int/Ext	350/389
<b>US ROBOTICS</b>	
16.8 HST ext. w/ ASL	569
Dual 16.8 HST ext	749
Shared Access Kit	649
<b>ZOOM</b>	
FC 9624	99

## Printers

<b>CANON</b>	
LPB4+/LBP8+	919/1499
BJ20	399
BJ 300/330	469/599
<b>DICOMIX</b>	
180s/701	299/439
<b>EPSON</b>	
LX810/AP 3250	155/219
FX850/FX1050	289/379
LQ570/LQ870	269/435
LQ1070/LQ1170	375/579
LQ2550	849
EPL8000/7500	1295/call
DFX5000/8000	1269/2139
<b>HEWLETT-PACKARD</b>	
Laser Series III/IIID	1549/2599
Laser IIIP/IIIP	869/1069
Desk Jet 500/500c	399/759
<b>IBM Laser</b>	
6/6P	1479/1825
10/10P	1749/2899
<b>NEC</b>	
Silentwriter 95	1469
<b>OKIDATA</b>	
184/380	229/219
320+/390+	314/439
321+/391+	435/595
393+/393C+	919/999
400/800 LASER	599/925
810/820 LASER	1064/1249
830/840 LASER	1269/1589
3410	1299
<b>PANASONIC</b>	
1123/1124i	199/275
1624/1654	339/539
2180/2123	175/255
1695/2624	369/379
4410/4450i	649/1079
4430/4455	909/1719
<b>QMS</b>	
PS 410/815	1529/2949
Color Script 100 model 10p	4699
<b>LASER ACCESSORIES</b>	
Upgrade for HP III 1 mb	79
Upgrade- HP III 2mb/4mb	109/179
Pacific Data 25-N-1	249
Pacific Page PE/PEXL	269/649
Pacific Connect 256K	249
Complete Font Library	249
Font Bank Cartridge 1.5 Mb	269

## Memory Boards

<b>AST</b>	
Six Pack+ w/384K XT	129
Six Pack286 w/OK AT	95
RamPack PC w/ 1 mb	285
<b>ORCHID</b>	
Ramquest 16/32 w/OK PS/2	199
Ramquest 8/16 w/OK XT/AT	129
<b>ACCELERATOR BOARDS</b>	
Orchid Tiny Turbo 286/Extra	119/179

## Bulldog Systems

**Bulldog's Standard Configuration**  
Dual Floppy Drives • Super VGA Card  
with 1 Mb RAM • 14" Color VGA  
Monitor (1024 x 768) • DOS 5.0 •  
Windows 3.1 • Mouse • 1 year  
warranty!  
386-SX/25 w/ 2 MB w/ 80 MB HD 1249  
386-33 (64K CACHE) 4MB, 130HD  
\$1549  
486-33 (256K CACHE) 4MB, 213MB HD  
\$2395  
486-50 (256K CACHE) 4MB, 213MB HD  
\$2650  
Call for other configurations

## Drives

<b>CONNER</b>	
120 IDE 3.5/200IDE 3.5	349/549
<b>IONEGA</b>	
90 MB Insider/Transportable	579/689
Dual 90 ext	1495
<b>MAGNAVOX</b>	
461RS EXT CDw/ software	369
<b>MAXTOR</b>	
7120A 130 mg	369
7213 A 210 mg	589
<b>MICRO SOLUTIONS</b>	
Backpack Ext. Floppy 1.2/1.44	189
<b>NEC</b>	
CDR 84 int/74 ext	509/549
CDR 37 portable	389
<b>QUANTUM PASSPORT XL removable</b>	
50MB/105MB	359/495
120MB/240MB	699/869
<b>SEAGATE</b>	
ST3096A 89 mb IDE	289
ST 3144A 120 IDE	379
<b>SYSGEN-Mobile Disk</b>	
40/80/120	399/569/649
<b>FLOPPY DRIVES</b>	
360K/1.2MB/1.44MB	59/59/59

## Tape Drives

<b>IRWIN</b>	
Accutrak 120/250	189/239
<b>COLORADO MEMORY SYSTEMS</b>	
DJ10 120 Meg Int Jumbo	199
DJ20 250 Meg Int Jumbo	259
QFA 700 Meg Int	719
<b>MICRO SOLUTIONS</b>	
40/120 Backpack	365
80/250 Backpack	429

## Mice & Misc.

Microsoft Mouse w/Windows 3.1	149
Microsoft Ball Point Mouse	118
Logitech Fotoman	519
Logitech Trackman Serial	69/85
Epson 300C w/ interface	1175
Logitech Scan Man 256	269
Sound Blaster Pro	189

610 Industrial Park Drive  
Evans, Georgia 30809  
PO Box 211043, Martinez, GA 30907  
OPEN weekdays: 8:30 a.m. to 6:00 p.m.  
(706) 860-7364 • FAX (706) 860-7358



**BULLDOG**  
COMPUTER PRODUCTS

No charge for direct order. Shipping and handling extra (minimum \$5). APO & FPO addresses additional \$10 (the rest stay the same). Product warranties, offers, and claims are handled by the manufacturer. DOA's repaired or replaced at our option during the first 30 days only. No returns on used items. All return shipments are subject to a 15% minimum restocking fee. Collectible software (specialty items) return only. Call 404-860-7364 for return authorization number prior to returning any product. Shipping charges are non-refundable. Bulldog cannot guarantee compatibility. All prices are in U.S. dollars and are subject to change and availability. Georgia residents add sales tax.

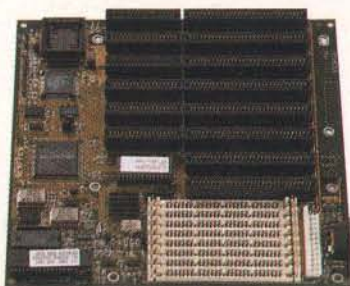


Avoid  
Old Age...

---



# RMB Motherboards



## 386SX-25 MHz \$149

25MHz processor speed  
Headland HT18 80386sx chip set  
IBM™ AT-bus compatible  
AMI BIOS (64 Kb)  
AMD CPU  
Up to 16 Meg on-board RAM memory

Buy any RMB motherboard with SIMM memory and we'll install the memory FREE. And we won't stop there...Ralin will also run a full diagnostic and burn-in your memory onto the motherboard at no charge. It's service like this that sets Ralin apart from our competition and makes our 1st time customer a customer for life.

Model	No Memory	2 Mb	4 Mb	8 Mb	16 Mb	32 Mb
386 SX-25	'149	'229	'309	'469	'809	NA
386 SX-33	'189	'269	'349	'509	'849	NA
** 386 DX-33	'275	NA	'435	'595	'935	'1595
** 386 DX-40	'285	NA	'445	'605	'945	'1605
486 SX-25	'295	NA	'455	'615	'955	'1615
* 486 SX-25 Local Bus Slot	'349	NA	'509	'669	'1009	'1669
** 486 DX-33	'599	NA	'759	'919	'1259	'1919
*** 486 DX-33 Upgradable	'675	NA	'835	'995	'1335	'1995
*** 486 DX-33 Local Bus Slot	'685	NA	'845	'1005	'1345	'2005
*** 486 DX-50 Upgradable	'899	NA	'1079	'1259	'1599	'2295
*** 486 DX-50 Local Bus Slot	'899	NA	'1079	'1259	'1599	'2295

\*64k Cache Memory \*\*128k Cache Memory \*\*\*256k Cache Memory

Future Upgradability: 486 DX-33 to → DX-2/66 MHz or 486 DX-50 to → DX-2/100 MHz

**Buy Smart...Buy RMB Upgradable Motherboards**

# Upgrade!

## Case Upgrades

If your computer case doesn't have room for more floppies or tape back-up, consider upgrading to a new Ralin case. Our cases offer the flexibility you require at a price that can't be beat.



### Desktop Case \$87<sup>00</sup>

5-bay Desktop Case  
200 watt Power Supply  
(3) - 5.25" bays  
(2) - 3.5" bays  
16.3 inch, 16 inch & 7 inch



### Mini Tower \$75<sup>00</sup>

4-bay Mini Tower Case  
200 watt Power Supply  
(2) - 5.25" bays  
(2) - 3.5" bays  
7 inch, 16 inch & 13.6 inch



### Full Tower \$139<sup>00</sup>

9-bay Full Tower Case  
230 watt Power Supply  
(6) - 5.25" bays (4-ext. & 2-int.)  
(3) - 3.5" internal bays  
Digital Display

**W**ith today's rapidly changing technology, your computers can be outdated before you know it. Avoid the aging PC syndrome by upgrading with quality components from Ralin. Our specially trained representatives sell thousands of motherboards and upgrade components every month. And our low prices will get your PC's up-to-date at a fraction of the cost of replacement.

Ralin offers a complete line of brand name products to complete your upgrade. Use this check list of key upgrade components when planning your next PC modification.

- ☐ Motherboard
- ☐ Memory
- ☐ Case w/Power Supply
- ☐ IDE MIO card
- ☐ Floppy Drive(s)
- ☐ Hard Drive (IDE)
- ☐ Keyboard
- ☐ DOS 5.0
- ☐ Tape Backup
- ☐ Mouse

## 30-Day Guarantee

At Ralin, if you're not satisfied, we're not satisfied. We offer a full 30-day guarantee on all merchandise. Items can be returned up to 30 days following the material invoice date. Some restrictions apply, call a customer service representative for details. 1-800-752-9512.

**Call 1-800-752-9512 today and talk to the**

### Ralin Policies

- Prices and availability subject to change.
- Purchase orders are accepted, subject to approval.
- We do not charge your card until order is processed.
- Incomplete returns are subject to a service charge.
- All returns other than exchanged items incur a 10% re-stocking fee.

- Not responsible for compatibility problems and typos.
- 30 day guarantee does not apply to software. Defective software exchanged only.
- APO and FPO's please call for shipping charges or for credit card orders leave blank when mailing order and applicable charges will be added.

To insure your shipment arrives when you need it, Ralin only the most reputable modes of transportation available.





## MPC Upgrades

### Creative Labs MPC Upgrade Kit \$585<sup>00</sup>



Creative Labs has combined a Panasonic MPC internal CD-ROM (works off the Sound Blaster SCSI port) and their own Sound Blaster Pro MPC sound card, with a bundle of the most popular CD software to offer an unbeatable upgrade value.

#### Kit includes:

- Panasonic MPC CD-ROM drive
- Sound Blaster Pro MPC sound card
- Microsoft™ Windows 3.1 on 3.5 inch disks
  - CD-ROM software: Microsoft™ Bookshelf, Creative Sounds, The Selectware System, Sherlock Holmes - Consulting Detective
- Sound Blaster Software:
  - The Talking Parrot
  - Text to Speech & Dr. Saitso
  - Voice Editor II
  - MultiMedia & MM Play
  - CD Play
  - FM Intelligent Organ

### Sound Blaster Pro Package \$195<sup>00</sup>



- Sound Blaster Pro sound card
- Sound Blaster Pro software bundle (6 titles)
- CD-ROM software: ChessMaster 3000 (MPC) and Wing Commander with Ultima VI

## Communications Upgrades



### Zoom Telephonics

Zoom modems rate at the top of their class for compatibility and performance. The recipient of numerous Editors' Choice awards, Zoom modems offer the quality and dependability that you require at a price that makes them a true value. All Zoom modems are backed by a 7 Year Warranty and are made in the USA.

2400 bps w/ v.42bis and MNP 2-5	(AMC) (AMX)	internal external	\$ 57.00 \$ 65.00
2400 bps w/ v.42bis and MNP 2-5 9600 send & 4800 receive Fax	(AFC) (AFX)	internal external	\$ 69.00 \$ 82.00
2400 bps w/ 9600 bps send/receive Fax	(FC 9624) (FX 9624)	internal external	\$105.00 \$105.00
9600 bps modem w/ v.32, v.42bis, MNP2-5	(VP-V32) (VX-V32)	internal external	\$199.00 \$199.00
14,400 bps modem w/ v.32bis, v.32, v.42bis, MNP 2-5 and 9600 bps send/receive Fax	(VFP-V32bis*) (VFX-V32bis*)	internal external	\$269.00 \$299.00

\*WINFAX software option available for \$15 if purchased with VFP-V32bis or VFX-V32bis modem.

## Printer Upgrades

If your printer is behind the times and can't keep up with your workload, consider an upgrade to the latest Star Micronics has to offer. Star's award winning NX-2420 Rainbow 24-pin color printer can supply the letter quality, crispness and speed you need, plus seven vibrant colors to make your print outs come alive. If it's laser quality you require, the StarJet ink jet printer can produce professional laser quality at a fraction of the cost of a true laser printer.



### NX-2420 Rainbow \$279<sup>00</sup>

- 250 cps draft speed
- 83 cps letter quality
- 5 fonts
- 7 color output
- 10 Enhancement modes
- User switchable push/pull tractor
- IBM™ & Epson™ compatible



### StarJet SJ-48 ink jet \$289<sup>00</sup>

- 100 cps near laser quality speed
- 360 x 360 dpi high resolution available
- 4 near laser quality fonts
- 13 scalable fonts with windows
- 2 paper paths
- IBM™, Epson™ and NEC™ 24-pin graphics compatible

## Upgrade Specialists.

Hours: 8:00 am to 7:00 pm Monday - Friday  
Customer Service: 716-674-6267 • Fax: 716-674-2108

WE ACCEPT:



**WHOLESALE, INC.**  
P.O. Box 450  
Orchard Park, New York 14127





## 8 Reasons To Call 1-800-982-2925

1. Established 1986
2. We accept P.O.'s
3. Guaranteed Lowest Prices
4. At Least A One Year Warranty

5. Non Commissioned Sales Staff
6. Overnight Delivery Available
7. We Carry Every Available Memory Application
8. No Surcharge On Credit Cards

### COMPAQ MEMORY

MEMORY MODEL	COMPAQ ADDED	YOUR EQUIV. PART#	COST
DESKPRO 286/4, 386/4, 386SX/20	2MB MODULE	118689-001	94. <sup>00</sup>
	4MB MODULE	118690-001	164. <sup>00</sup>
DESKPRO 386/16	1MB-2MB BOARD	108069-001	299. <sup>00</sup>
	2MB BOARD	108069-001	348. <sup>00</sup>
	1MB KIT	108070-001	114. <sup>00</sup>
	4MB-8MB BOARD	108070-001	545. <sup>00</sup>
	4MB KIT	108072-001	249. <sup>00</sup>
DESKPRO 386/5	4MB BOARD	113634-001	228. <sup>00</sup>
	4MB MODULE	112534-001	169. <sup>00</sup>
DESKPRO 386/20, 20E, 25, 25E	1MB MODULE	113131-001	59. <sup>00</sup>
	4MB MODULE	113132-001	169. <sup>00</sup>
DESKPRO 386/20E/25E	4MB BOARD	113645-001	224. <sup>00</sup>
DESKPRO 386/33, 486/25/33/33	1MB-4MB MODULE	115144-001	114. <sup>00</sup>
	8MB MODULE	116561-001	309. <sup>00</sup>
SYSTEMPRO	32MB MODULE	116568-001	1650. <sup>00</sup>

### TOSHIBA MEMORY

MEMORY TOSHIBA MODEL	TOSHIBA ADDED	YOUR EQUIV. PART #	COST
T1000SE & XE/LE	2MEG	PC14-PA8312U	119. <sup>00</sup>
T2000SX/T2000	2MEG	PC18-PA8317U	119. <sup>00</sup>
T2000SX/T1000LE	4MEG	PC-PA8314U	199. <sup>00</sup>
T2000SX/T1000LE	8MEG	PC-PA8315U	379. <sup>00</sup>
T2000SX/2200SX	2MEG	PC-PA2000U	119. <sup>00</sup>
T2000SX/2200SX	4MEG	PC-PA2001U	208. <sup>00</sup>
T2000SX/2200SX	8MEG	PC-PA2002U	379. <sup>00</sup>
T1200XE	2MEG	PC13-PA8306U	95. <sup>00</sup>
T1400	2MEG	PC8-PA8302U	95. <sup>00</sup>
T3100E	2MEG	PC9-PA8341U	95. <sup>00</sup>
T3100SX	2MEG	PC15-PA8308U	95. <sup>00</sup>
T3100SX	4MEG	PC15-PA8310U	174. <sup>00</sup>
T3200	3MEG	PC6-PA7137U	159. <sup>00</sup>
T3200SX	2MEG	PC12-PA8307U	99. <sup>00</sup>
T3200SX	4MEG	PC12-PA8309U	174. <sup>00</sup>
T3200SX	2MEG	PC19-PA8318U	99. <sup>00</sup>
T3200SX	4MEG	PC19-PA8319U	169. <sup>00</sup>
T5100	2MEG	PC7-PA8301U	99. <sup>00</sup>
T8500 or T5200 & T5200C	2MEG	PC10-PA8304U	104. <sup>00</sup>
	8MEG	PC10-PA8313U	339. <sup>00</sup>

### IBM MEMORY

MEMORY IBM PS/2 MODEL#	IBM ADDED	YOUR EQUIV. PART#	COST
PS/1, 386SX	2MB	92F9935	79. <sup>00</sup>
30-286	512K KIT	30F5348	35. <sup>00</sup>
	2MB KIT	30F5360	94. <sup>00</sup>
486SX & N33SX LAPTOP	2MEG	79F0999	89. <sup>00</sup>
	4MEG	79F1000	149. <sup>00</sup>
	8MEG	79F1001	319. <sup>00</sup>
502 & 55SX, 65SX	1MB SIMM	6450603	51. <sup>00</sup>
35SX, LS, 40SX	2MB SIMM	6450604	79. <sup>00</sup>
70-161, 041, 121, P70	4MB MODULE	34F2933/87F9777	149. <sup>00</sup>
40SX, 55SX, 65SX, 35SX, 385	2-8MB BOARD	1497259/6450609	259. <sup>00</sup>
50, 502, 55SX & 60, 65SX	2MB SIMM	6450608	94. <sup>00</sup>
70-A21 A61, B21, B61	1MB MODULE	6450375	69. <sup>00</sup>
80-041	2MB MODULE	6450379	109. <sup>00</sup>
80-111, 121, 311, 321	4MB MODULE	6451060	199. <sup>00</sup>
80-A21, A31	8MB	6450129	339. <sup>00</sup>
35SX, LS & 40SX	2-8MB BOARD	6450605	249. <sup>00</sup>
ALL 70s & 80s	2-14MB BOARD	34F3077	289. <sup>00</sup>
	4-16MB BOARD	34F3011	488. <sup>00</sup>
57SX, 90, 95, P75	4MB	6450128	159. <sup>00</sup>
	8MB	6450130	339. <sup>00</sup>

CONNOR 200MB \$459

### The Maxtor 7213. It drives a hard bargain.



3.5" 213MB, 15ms  
IDE or SCSI Interface  
**\$479.<sup>00</sup>**  
(40 Meg 179.00)  
Maxtor

### IBM PS2 HARD & FLOPPY DRIVES

All Hard and Floppy Drives Work With PC, PS2 & Laptop Computers

1.2MB Parallel Port Floppy	\$179. <sup>00</sup>
1.44MB Parallel Port Floppy	179. <sup>00</sup>
42MB Parallel Port Hard Drive	349. <sup>00</sup>
84MB Parallel Port Hard Drive	449. <sup>00</sup>
124MB Parallel Port Hard Drive	499. <sup>00</sup>

All Drives Include External Drive, Interface, Software, Cable & Manual. No Controller Required.

### MOTHER BOARDS

CPU COST	SPEED	CACHE	BUS	EXP	YOUR
486DX	50MHZ	256K	EISA	64MEG	\$1299. <sup>00</sup>
486DX	50MHZ	256K	ISA	64MEG	845. <sup>00</sup>
486DX	33MHZ	256K	EISA	32MEG	899. <sup>00</sup>
486DX	33MHZ	64K	ISA	32MEG	645. <sup>00</sup>
486SX	25MHZ	64K	ISA	32MEG	365. <sup>00</sup>
386DX	40MHZ	64K	ISA	32MEG	299. <sup>00</sup>
386DX	33MHZ	64K	ISA	32MEG	259. <sup>00</sup>
386SX	25MHZ	64K	ISA	32MEG	149. <sup>00</sup>

### UPGRADE YOUR CPU!



Works with IBM PS/2 Models 30/286, 50, 502, 60 & HP Models E58, E512. Changes your machine to a 25MHz 386SX for only:

**\$299.00**

ADD \$50 FOR OTHER TYPE COMPUTERS  
Specify Machine Type

### RAM CHIPS

DESCRIPTION	150NS	120NS	100NS	80NS	70NS	60NS
64X4	1. <sup>00</sup>	2. <sup>25</sup>	2. <sup>45</sup>	2. <sup>95</sup>		
256X1 STATIC				1. <sup>00</sup>	2. <sup>25</sup>	
256X1	. <sup>00</sup>	1. <sup>00</sup>	1. <sup>10</sup>	1. <sup>15</sup>	1. <sup>45</sup>	2. <sup>00</sup>
256X4		3. <sup>00</sup>	4. <sup>45</sup>	4. <sup>10</sup>	5. <sup>45</sup>	4. <sup>95</sup>
1MEGX1		3. <sup>00</sup>	3. <sup>25</sup>	4. <sup>10</sup>	4. <sup>45</sup>	4. <sup>95</sup>
1MEGX1 STATIC				4. <sup>95</sup>	5. <sup>25</sup>	
1MEGX4				17. <sup>00</sup>		

### SIMM MODULES

DESCRIPTION	100NS	80NS	70NS	60NS
256X9	9. <sup>00</sup>	10. <sup>00</sup>	11. <sup>00</sup>	15. <sup>00</sup>
1MEGX3	28. <sup>00</sup>	29. <sup>00</sup>	30. <sup>00</sup>	34. <sup>00</sup>
4MEGX X 9	29. <sup>00</sup>	33. <sup>00</sup>	34. <sup>00</sup>	37. <sup>00</sup>
1MEGX X 9		114. <sup>00</sup>	118. <sup>00</sup>	139. <sup>00</sup>
256X36 1MEG	69. <sup>00</sup>	69. <sup>00</sup>	69. <sup>00</sup>	69. <sup>00</sup>
512X36 2MEG	93. <sup>00</sup>	93. <sup>00</sup>	103. <sup>00</sup>	
1X36 4MEG	159. <sup>00</sup>	159. <sup>00</sup>	184. <sup>00</sup>	
2X36 8MEG	344. <sup>00</sup>	344. <sup>00</sup>	364. <sup>00</sup>	
4X36 16MEG	644. <sup>00</sup>	644. <sup>00</sup>	659. <sup>00</sup>	

### COMPUTER PERIPHERALS, INC.

#### MEMORY BOARD

#### 2MEG for 286 & 386's

16 Bit. 2MB expandable to 4MB. (Uses 1MB x 1Dips) Works with IBM AT, 386 and compatibles. Expanded, Extended, 4.0 Lim compatible.

**2MEG \$69 4MEG \$119**



### BOCA MEMORY BOARDS

5 YEAR WARRANTY

#### 80286 & 386 AT MACHINES

BOCA AT PLUS / BIAIT 90 USES 1MEG SIMMS / OK-8MEG 80. 4.0 LIM COMPATIBLE. CONVENTIONAL, EXPANDED & EXTENDED MEMORY. SUPPORTS DOS, OS/2, LM/EMS & EMS

OK-94.<sup>00</sup> 2MEG-159.<sup>00</sup> 4MEG-249.<sup>00</sup> 8MEG-369.<sup>00</sup>

BRAT 80 - \$79.00

BOCAMAR-2 PLUS

16 BIT MEMORY FOR ALL IBM ATCA SYSTEMS. DOS & OS/2 LIM EMS 4.0 SUPPORT. 2-8 MB USES 1 MB SIMMS. 2MB \$194 4MB \$279 8MB \$449

### LASER MEMORY

	1MEG	2MEG	4MEG
HP II 20, 3, 30, 3P, 2P, 2P	109	169	
HP II 51	59	109	149
IBM LASER 4019, 4019E	89	135	189
IBM LASER 4029	184	184	184
PANASONIC 4410/4430	129	209	319
PANASONIC 4420/4450	89	129	209
PANASONIC 4450	119		
PANASONIC 4455	139		
NEC 95			134
NEC 95			174
ONE-410			109
TI XLPS17/PS35			59
CANON LBP4			154
STAR L504			129
EPSON ACTION LASER II			149
EPSON 6000, ACTION LSR			125
TOSHIBA PAGE LASER 6			125
PACKARD BELL HP500			125
HP DESKJET 300, 300C			69. <sup>00</sup> (250C)

### SYSTEMS! SYSTEMS!

#### 8088 XT 10MHZ

#### W/40MEG Hard Drive

640K memory, 360K floppy, Par-Ser-Clock, 12" Amber Monitor, 101 Key Keyboard. 6 month warranty.

#### COMPLETE HARD DRIVE SYSTEMS:



**\$299**



### MODEMS & FAXES

**2400 Baud.** Hayes compatible; supports extended AT Command Set. Comm 1-4 & IRQ 3-5 & 7. On board speaker, software & telephone cord. **Internal \$39**

**External \$79**

V.42 BIS MNP5 Hardware add \$50

**Fax Modem.** Send & receive 9600 BPS fax & 2400 BPS Modem.

Hayes compatible. On board speaker. Mirror fax software.

Port address Com 1-4. **\$79**

14.4 Baud V.32 Bis Add \$190

### CD ROM

Magnavox	External	757MB, 700MS	\$299. <sup>00</sup>
	Internal	680MB, 375MS	\$379. <sup>00</sup>
Chinon	External	600MB, 350MS	\$499. <sup>00</sup>
	Internal	600MB, 350MS	\$369. <sup>00</sup>
Tishiba	External	683MB, 325MS	\$549. <sup>00</sup>
	Internal	683MB, 325MS	\$429. <sup>00</sup>

All CD Rom's come complete with software interface and documentation.

### SOUND CARDS

Sound Blaster/Pro/Basic ..... \$94/\$188/\$145

### intel COPROCESSORS

	80386 BASED MACHINES:	80387	16MHz	79. <sup>00</sup>
		80387-20MHz	84. <sup>00</sup>	
		80387-25MHz	89. <sup>00</sup>	
		80387-33MHz	94. <sup>00</sup>	
		80387-SX16	79. <sup>00</sup>	
		80387-SX20	89. <sup>00</sup>	
		80387-SX20	399. <sup>00</sup>	

5 YEAR WARRANTY, WE'LL NEVER BE UNDERSOLD!

### FONT CARTRIDGES FOR HP & COMPATIBLES

#### COMPUTER PERIPHERALS, INC.

**Action Set!** 102 fonts, same as HP's Pro Collection, compatible with HP, Epson etc. **\$89.<sup>00</sup>**

**Super Set!** 425 Fonts, Comparable to Pacific Data 25 in 1, HP's Pro Collection and HP's Microsoft. **\$249.<sup>00</sup>**

**Desk Set!** 118 fonts for HP 500, 500C, 5 to 30 ft. **\$114.<sup>00</sup>**

**Jet Page!** Postscript for HP **\$199.<sup>00</sup>**

#### ORDERS ONLY

**800-982-2925**

TECHNICAL/CUSTOMER SERVICE/ORDER STATUS:

(702) 294-0204 FAX (702) 294-1168

FAX ORDERS WELCOME

WE PURCHASE EXCESS INVENTORY! CALL OR FAX LIST

Mfg. part #'s for convenience only. Most memory products 3rd party. International orders shipped DHL or Air Mail. Trademarks are registered with their respective Co.'s. 386, 387, 287, SX, are trademarks of Intel Corp.

**CONDITIONS:** 20% Restocking Fee on refunds within 30 days. No refunds or exchanges after 30 days - WARRANTY REPLACEMENT ONLY. ALL PRICES FINAL. PRICES SUBJECT TO CHANGE

**TERMS:** NO SURCHARGE FOR MC/VISA/AE SHIPPING: UPS (Min. \$8.25) NET 30 Accepted. Purchase orders from Universities, Fortune 1000 & Government Agencies/Personal Checks, COD add \$5.00 (Cashiers check required) \*Net price on some items under some terms. WE ACCEPT INTERNATIONAL ORDERS



684 Wells Road  
Boulder City, NV  
89005

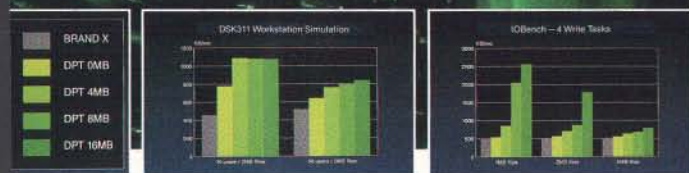




**DPT**

# Break into Higher Performance!

SmartCache Plus is the SCSI controller that delivers  
higher performance without a higher price!



Windows, Netware, Unix and other high-end applications need a SCSI controller that delivers top disk I/O performance and a growth path. Only SmartCache Plus delivers both — and costs no more than less advanced controllers!

As the industry's fastest SCSI controller, SmartCache Plus is the easy choice. It's the smart choice, too — because if your system needs a performance boost, you can transform it from a non-caching host adapter into the world's fastest *caching* controller! Expandability is so simple: plug-on modules add caching, up to a total of 16MB of cache memory, and disk mirroring!

SmartCache Plus is supported by all major operating systems and applications, and provides connectivity to hundreds of SCSI devices. Reliable, scalable and simple to install, SmartCache Plus breaks your system's disk I/O bottleneck without breaking your budget!

Distributed Processing Technology  
140 Candace Drive, Maitland, FL 32751

## GET THE FACTS!

*This free comprehensive Performance Report details the SmartCache Plus advantage over its leading competitor in nine different benchmarks for DOS 5.0, Netware 3.11 and Unix applications. For your copy, contact DPT Channel Marketing today...*

TEL. **407-830-5522**  
FAX **407-260-5366**

See us at COMDEX Booth No. 1596

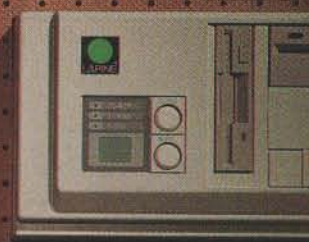
All trademarks are the property of their respective owners.

Circle 235 on Inquiry Card (RESELLERS: 236).



## POWERTOOLS® by Lapine®

- **50x FASTER GRAPHICS**  
32-bit local bus graphics accelerator with the potent S3 accelerator chip. Standard on LP-433L and LP-450L.
- **30x FASTER ACCESS**  
New 8MB Cache controller for 5MB per second data transfer. 30x faster hard drive access, available upgrade on all Lapine Powertools.
- **32,000 COLORS!**  
Standard on all Lapine Powertools.
- **PROGRAMMABLE KEYBOARD**  
Brand new microprocessor based Lapine 101 key programmable keyboard. Multiple functions with one keystroke. Standard on LP-433L and LP-450L.
- **FREE LOTUSWRITE® or LOTUSWORK®**  
Your choice with any system purchase:



# Power Is Within Your Reach.

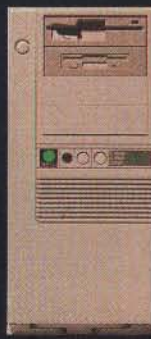
Powertools by Lapine are the office machines that make all the difference for all kinds of businesses.

Lapine is the first computer manufacturer to offer local bus computing with the S3 graphic accelerator chip for 32-bit, 33 and 50mhz processing of graphics. This means graphics that are 50x faster than standard 16-bit processing. The local bus feature is standard on LP-433L and LP-450L models.

Powertools are designed right. Whether it be our true tactile programmable and non-programmable keyboards, ergonomic stylings or crystal



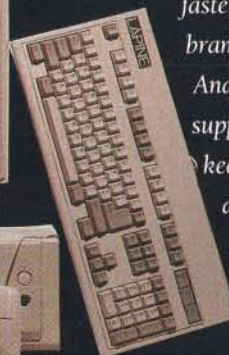
Mini Upright



Standard Upright



Desktop



clear monitors; we invite comparison. You'll find Lapine's superior quality is evident.

For 5 years Lapine has been committed to bringing corporate America the absolute latest technology faster than any other name brand computer manufacturer. And Lapine's service and support team is dedicated to keeping your office running at maximum efficiency.

Owning a Lapine Powertool puts a great computer and a great company in your hands.



# POWERTOOLS<sup>®</sup>

by Lapine<sup>®</sup>

## 386-33/40Mhz LP-333/40

- 4MB (70ns) RAM 64K Cache
- 125MB fast IDE hard drive with Cache
- TEAC<sup>®</sup> 1.2 and 1.44MB floppies
- ★ 16-bit 1MB SVGA card with 32,000 color Sierra<sup>®</sup> DAC chip
- 14" non-interlaced .28 1024x768 SVGA monitor
- 2 serial/1 parallel/1 game port
- LAPINE 101 key tactile keyboard
- MS-DOS 5.0 and WINDOWS<sup>™</sup> 3.1 with hi-resolution mouse
- 280 watt power supply
- FREE LOTUSWORKS<sup>®</sup> or LOTUSWRITE<sup>®</sup> for WINDOWS FREE!

**\$1392**

*Your choice of desktop or mini upright*

- Same system as above with 8MB RAM, 256K Cache and 200MB hard drive \$1742
- 17" flat screen SVGA digital mon. add \$520

## 486-33Mhz LP-433

- 4MB (70ns) RAM 64K Cache
- 125MB fast IDE hard drive with Cache
- TEAC<sup>®</sup> 1.2 and 1.44MB floppies
- ★ 16-bit 1MB SVGA card with 32,000 color Sierra<sup>®</sup> DAC chip
- 14" non-interlaced .28 1024x768 SVGA monitor
- 2 serial/1 parallel/1 game port
- LAPINE 101 key tactile keyboard
- MS-DOS 5.0 and WINDOWS<sup>™</sup> 3.1 with hi-resolution mouse
- 280 watt power supply
- FREE LOTUSWORKS<sup>®</sup> or LOTUSWRITE<sup>®</sup> for WINDOWS FREE

**\$1742**

*Your choice of desktop or standard upright*

- Same system as above with 8MB RAM, 256K Cache, and 200MB hard drive \$2092
- 17" flat screen SVGA digital mon. add \$520

## 486-50Mhz LP-450

- 4MB (60ns) RAM 64K Cache
- 125MB fast IDE hard drive with Cache
- TEAC<sup>®</sup> 1.2 and 1.44MB floppies
- ★ 16-bit 1MB SVGA card with 32,000 color Sierra<sup>®</sup> DAC chip
- 14" non-interlaced .28 1024x768 SVGA monitor
- 2 serial/1 parallel/1 game port
- LAPINE 101 key tactile keyboard
- MS-DOS 5.0 and WINDOWS<sup>™</sup> 3.1 with hi-resolution mouse
- 280 watt power supply
- FREE LOTUSWORKS<sup>®</sup> or LOTUSWRITE<sup>®</sup> for WINDOWS FREE!

**\$2042**

*Your choice of desktop or standard upright*

- Same system as above with 8MB RAM, 256K Cache, and 200MB hard drive \$2392
- 17" flat screen SVGA digital mon. add \$520

## 486-33 local bus LP-433L

- 4MB (70ns) RAM 64K Cache
- 125MB fast IDE hard drive with Cache
- TEAC<sup>®</sup> 1.2 and 1.44MB floppies
- ★ 32-bit local bus S3 graphics accelerator for 50x faster graphics with up to 1280x1024 resolution and 32,000 colors
- 14" non-interlaced .28 1024x768 SVGA monitor
- 2 serial/1 parallel/1 game port
- ★ Programmable 101 key LAPINE keyboard
- MS-DOS 5.0 and WINDOWS<sup>™</sup> 3.1 with hi-resolution mouse
- 280 watt power supply
- FREE LOTUSWORKS<sup>®</sup> or LOTUSWRITE<sup>®</sup> for WINDOWS FREE!

**\$1942**

*Your choice of desktop or standard upright*

- Same system as above with 8MB RAM, 256K Cache, and 200MB hard drive \$2292
- 17" flat screen SVGA digital mon. add \$520

## 486-50 local bus LP-450L

- 4MB (60ns) RAM 64K Cache
- 125MB fast IDE hard drive with Cache
- TEAC<sup>®</sup> 1.2 and 1.44MB floppies
- ★ 32-bit local bus S3 graphics accelerator for 50x faster graphics with up to 1280x1024 resolution and 32,000 colors
- 14" non-interlaced .28 1024x768 SVGA monitor
- 2 serial/1 parallel/1 game port
- ★ Programmable 101 key LAPINE keyboard
- MS-DOS 5.0 and WINDOWS<sup>™</sup> 3.1 with hi-resolution mouse
- 280 watt power supply
- FREE LOTUSWORKS<sup>®</sup> or LOTUSWRITE<sup>®</sup> for WINDOWS FREE!

**\$2342**

*Your choice of desktop or standard upright*

- Same system as above with 8MB RAM, 256K Cache, and 200MB hard drive \$2692
- 17" flat screen SVGA digital mon. add \$520

## GRAND POWERTOOL 486-33 local bus GP-433L

- 16MB (60ns) RAM 256K Cache
- 1.2 Gigabyte fast SCSI hard drive
- TEAC<sup>®</sup> 1.2 and 1.44MB floppies
- ★ 32-bit local bus S3 graphics accelerator for 50x faster graphics with up to 1280x1024 resolution and 32,000 colors
- 17" non-interlaced 1280x1024 SVGA flat screen monitor w/digital control readout.
- ★ SCSI fast drive controller
- 2 serial/1 parallel/1 game port
- ★ Programmable 101 key LAPINE keyboard
- MS-DOS 5.0 and WINDOWS<sup>™</sup> 3.1 with hi-resolution mouse
- 280 watt power supply
- FREE LOTUSWORKS<sup>®</sup> or LOTUSWRITE<sup>®</sup> for WINDOWS FREE!

**\$4992**

*Your choice of desktop or standard upright*

- 486-50 local bus (GP-450L) \$5292

## LAPINE SERVICE

1 year on-site service to most locations  
1 year parts and 5 years labor  
Toll free technical support unlimited  
30-day money back guarantee  
Federal Express replacement parts  
Intensive 72-hr. burn-in & test  
Se habla español

## LAPINE OPTIONS

- Add additional megabytes of memory
- Greater capacity hard drives
- 15", 17", 20" monitors
- Low radiation monitors
- Tape backups
- CD ROM and multi-media
- And MORE!

Business Hours:  
Mon-Fri. 7am-7pm (PST)  
Saturday. 9am-3pm (PST)

8025 Deering Avenue, Canoga Park,  
California 91304  
818/884-3685 FAX 818/884-3670

**1-800-927-3772**  
**LAPINE**  
Business Compatible Computers.

All major credit cards accepted. Net 30 day credit terms to qualified government, educational & commercial accounts. All prices subject to change. Prices do not include shipping.

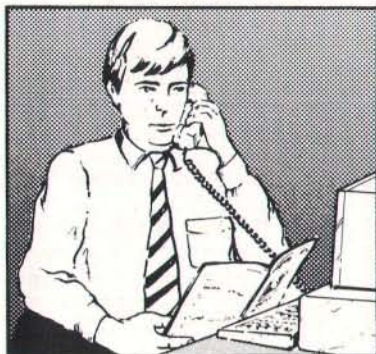
992 LAPINE Computers.

Circle 254 on Inquiry Card (RESELLERS: 255).

OCTOBER 1992 • BYTE 295



# Buy with Confidence



In an effort to make your telephone purchasing a more successful and pleasurable activity, The Microcomputer Marketing Council of the Direct Marketing Association, Inc. offers this advice, "A knowledgeable buyer will be a successful buyer." These are specific facts you should know about the prospective seller before placing an order:

## Ask These Important Questions

- How long has the company been in business?
- Does the company offer technical assistance?
- Is there a service facility?
- Are manufacturer's warranties handled through the company?
- Does the seller have formal return and refund policies?
- Is there an additional charge for use of credit cards?
- Are credit card charges held until time of shipment?
- What are shipping costs for items ordered?

Reputable computer dealers will answer all these questions to your satisfaction. Don't settle for less when buying your computer hardware, software, peripherals and supplies.

## Purchasing Guidelines

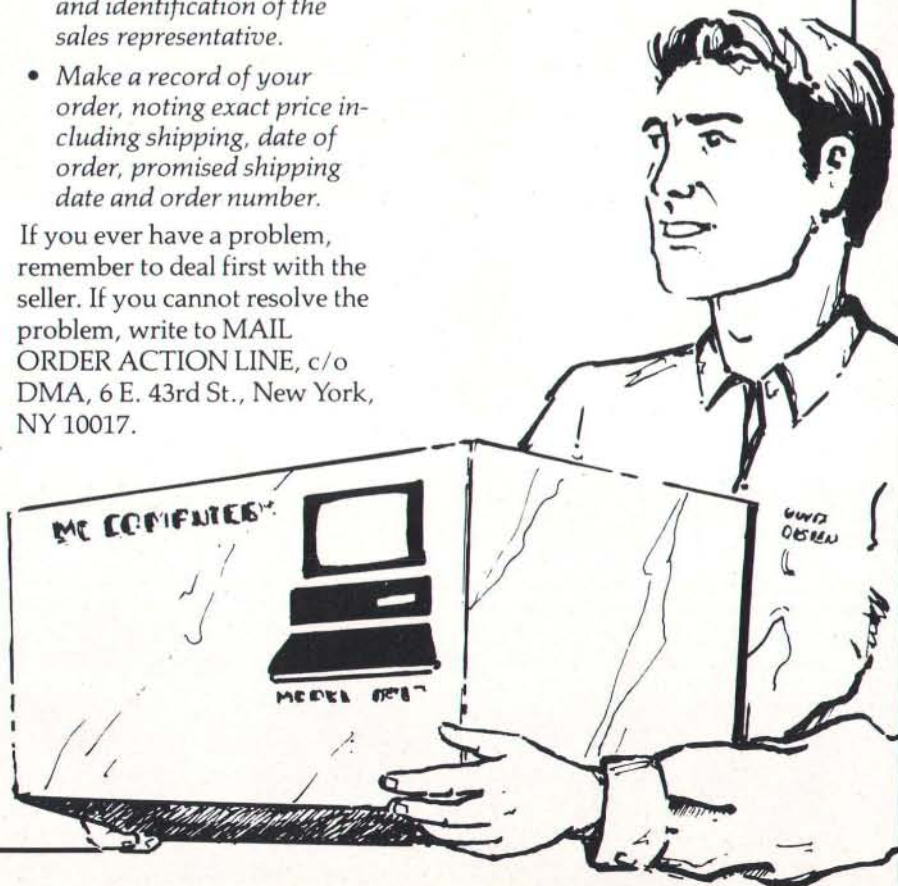
- State as completely and accurately as you can what merchandise you want including brand name, model number, catalog number.
- Establish that the item is in stock and confirm shipping date.
- Confirm that the price is as advertised.
- Obtain an order number and identification of the sales representative.
- Make a record of your order, noting exact price including shipping, date of order, promised shipping date and order number.

If you ever have a problem, remember to deal first with the seller. If you cannot resolve the problem, write to MAIL ORDER ACTION LINE, c/o DMA, 6 E. 43rd St., New York, NY 10017.

This message is brought to you by:

the MICROCOMPUTER  
MARKETING COUNCIL  
of the Direct Marketing  
Association, Inc.  
6 E. 43rd St.,  
New York, NY 10017

**MMC**  
MICROCOMPUTER  
MARKETING COUNCIL  
of the Direct Marketing Association, Inc.





# APS Technologies

## The SCSI Drive Specialists

### Why Choose SCSI? 5 Good Reasons

- Handles up to 7 devices (& floppy) w/one controller
- Supports CD-ROMs, Tape, DATs, Scanners and more
- Bus Mastering I/O
- Use "Workstation" Quality (and Performance) Peripherals
- Works with ST-506, ESDI Drive Controllers and IDE Controllers



### Quantum

MB	INTL	EXTL
120	399	479
240	659	729
425	969	1039

### Maxtor

MB	INTL	EXTL
120	\$359	\$439
213	499	569
340	859	959
535	1249	1349
760	1399	1499
1.2G	1849	1949

### Toshiba

MB	INTL	EXTL
830	\$1499	\$1599

### Fujitsu

MB	INTL	EXTL
520	1049	1149
1.2G	1699	1799
2.0G	2799	2899

### WREN

MB	INTL	EXTL
630	1649	1699
1.2G	1749	1849
1.6G	2549	2649

### SyQuest

Model	Bare
SQ-555	\$379
SQ-5110	499

Additional SyQuest Cartridges  
44MB - \$75 88MB - \$109

### DAT

Model	INTL	EXTL
APSDAT	\$1599	\$1699

2.6 - 5 GB Compression DAT

Model	INTL	EXTL
APSDAT	1349	1499

Desktop & Portable Units; Archive-based Mechanisms; Tape Drives Include Sytos Plus

### Micronics

Model	Cache	Price
386SX	ISA 25	\$259
386DX	ISA 25	399
386DX	ISA/33/Cache	449
486DX	ISA/33/Cache	859
486DX	EISA/33/Cache	1199
486DX	ISA/50/Cache	1449

### Toshiba

CD-ROM	Bare
3301B	\$579

### Why Buy from APS?

- Helpful, knowledgeable sales associates.
- Toll-free Technical Support—call as often or for as long as you need. See why APS has won 2 MACWORLD Service Hero awards!
- 30-Day, No-Questions-Asked, Money-Back Guarantee.\*
- Helpful, informative 160-page manual.

- Disk-for-Disk Replacement Warranty—you'll probably never need it, but if you do, 90% of our warranty service is performed within 48 hours (most within 24 hours). Return shipping via FEDEX Standard Overnight Service—no charge.
- 24-hour BBS with the latest version of our software.

Prices & Specifications Subject to Change Without Notice



M-F 7AM-9PM CST SAT 10AM-4PM CST

Visa/MC, Discover, AMEX—No Surcharge

International: 1-816 478-8300 FAX: 1-816 478-4596 (24 Hrs) Toll Free UK: 0800-897-545 Toll Free Australia: 0014-800-125-875

APS Technologies, 2900 S. 291 Hwy., Independence, MO 64057

# 1-800 235-3707



## MONITOR COMBO'S

Now's the time to add a Monitor Combo to your computer system. The VGA Combo's come with a 2 year warranty, and work AT, 386 and 486 computer systems.

**COMBO-MONO** \$99

12" Monographics Monitor with controller card.

**COMBO-VGA** \$289

640 x 480 VGA monitor with controller card and 256K video RAM. Works with AT or 386 computers.

**COMBO-SVGA** \$439

1024 x 768 Non-Interlaced Super VGA monitor with controller card and 1 MEG video RAM.



## HARD DRIVE COMBO'S

Now's the time to upgrade your computer system with our hard drive combo's. Change your outdated MFM drive to a faster more reliable IDE hard drive. Works with AT, 386 and 486 computers.

**COMBO-40** \$225

40 MEG IDE 28ms hard drive with controller card.

**COMBO-105** \$335

105 MEG IDE 15ms hard drive with controller card.

**COMBO-130** \$375

120 MEG IDE 19ms hard drive with controller card.

**COMBO-210** \$649

210 MEG IDE 15ms hard drive with controller card.

**GREAT  
NEW PRICES!**



## BOCA 14.4K MODEM



M1440I BOCA V.32BIS, 14.4K Modem Internal \$239

M1440E BOCA V.32 BIS, 14.4K Modem External \$319

BOCA Research FAX Send/Receive Modem. Uses Rockwell chip set, transmits and receives FAXES up to 9600 BAUD. Modem transmits and receives data up to 14.4K BAUD. Includes Quicklink II Software. Made in the U.S.A. and comes with BOCA 5-year warranty.

### ZOOM MODEMS

AMC-2400 Internal 2400 BAUD Modem \$59

AMX-2400 External 2400 BAUD Modem \$69

## MONITORS



RM9502 14" Monochrome VGA Monitor (800 x 350, 400, 480) \$139

- 2-year manufacturers' warranty

SC-428TX 14" Super VGA Monitor (1024 x 768) Non-Interlaced \$359

MON-05 Monochrome TTL Amber (720 x 348) 12" \$89

MON-06 Paper White TTL 14" \$112

MON-10 CGA/RGB (640x240) 14" \$219

MON-07 VGA .41 Dot Pitch 640 x 480 14" \$239

- One-year manufacturers' warranty

## TRIPP LITE POWER PRODUCTS

### Back-Up Systems

Part#	Each
BC-250	\$105
BC-400	\$169
BC-500	\$194
BC-500LAN	\$199
BC-600LAN	\$269
BC-900LAN	\$379
BC-1250LAN	\$529
BC-4000LAN	\$2549

### OMNI Back-Up Systems

Part#	Each
OMNI-450LAN	\$299
OMNI-600LAN	\$399
OMNI-900LAN	\$549
OMNI-1250LAN	\$679
OMNI-2000LAN	\$1149



### Line Stabilizer/Conditioners

UL listed and 2 year warranty.

Part#	Description	Each
LS-504	500 Watts, 230 Volt, 4 Outlets	\$98
LS-600	600 Watts, 2 Outlets	77
LS-604	LS-600 with HI voltage regulation	98
LC-1200	1200 Watts, 4 Outlets	139
LC-1800	1800 Watts, 6 Outlets	188
LC-2000	2000 Watts, 208/220/240 Volt	243
LC-2000X	220/240 V, 2000 watts, 6 Outlets	243
LC-2400	2400 watts, 110 V, 6 outlets	243
LCR-2400	2400 watt rack mt., 110 V, 14 outlets	287

### Modem Fax Protectors

2 year warranty.

Part#	Description	Each
ISOTEL	Lifetime warranty, 4 outlet, 6 ft. cord and modem protector ("Gold Seal")	\$59
ISOFAV	ISOBLOK w/ Modem protector	36
TSB	3 stage Modem/Fax protector	38
MP	Economy Modem/Fax protector	14
SMP	1 AC outlet w/modem/fax protector	29
SMP-GS	Lifetime guarantee. ("Gold Seal")	35

### TrippLite Isobars

All Isobars come with a lifetime warranty and UL listing.

Part#	Description	Each
IB2-0	2 outlet direct plug-in	\$23
IB2-0/20	2 outlet, 20 amp, direct plug-in	39
IB2-6	2 outlet, 6 ft. cord ("Gold Seal")	32
IB4	4 outlet, 6 ft. cord ("Gold Seal")	43
IB4/220	4 outlet, 6 ft. cord, 220 Volt	49
IB6	6 outlet, 6 ft. cord ("Gold Seal")	51
IB8	8 outlet, 12 ft. cord ("Gold Seal")	61
IB-8RM	8 outlet, 12 ft. cord w/remote power switch	69
EUROBAR	4 outlet, 6 ft. cord, 220/240 Volt Euro connectors	52
IBR-12	12 outlet, 19" rack mountable	89

## 3M DATA CARTRIDGES

DC2000-3M	40 Megabyte	\$14.99
DC2000T-3M	Thetamat for Colo. Mem.	17.99
DC2060T-3M	Thetamat for Colo. Mem.	22.99
DC2080R-3M	Rhomat for Irwin 80	15.99
DC2120-3M	120 Megabyte	18.49
DC2120R-3M	Rhomat for Irwin 80	22.99
DC300XL/P	45 Megabyte	18.29
DC600A-3M	60 Megabyte	19.99
DC6150-3M	150 Megabyte	20.99
DC6250-3M	250 Megabyte	24.99
D8-112-3M	8MM up to 5.0 GB	12.39

## 3M DISKETTES

### 3-1/2" Diskettes

Part#	Description	Per Box/10
3.5DS	DSDD	\$6.99
3.5DS/F	DSDD Formatted	7.49
3.5DSHD	DSHD	13.39
3.5DSHD/F	DSHD Formatted	13.99

### 5-1/4" Diskettes

Part#	Description	Per Box/10
5.25DS	DSDD	\$4.89
5.25DS/F	DSDD Formatted	5.39
5.25DSHD	DSHD	8.49
5.25DSHD/F	DSHD Formatted	9.19

## IIT MATH CO-PROCESSORS

100% Compatibility Guaranteed: 386DX, 386SX and 286 systems & software. Lower-Power for Portables • IIT Lifetime Warranty

2C87-12	For 286 up to 12.5 MHz	\$53
2C87-20	For 286 up to 20 MHz	60
3C87-20SX	For 386SX up to 20 MHz	68
3C87-25SX	For 386SX up to 25 MHz	70
3C87-33SX	For 386SX up to 33 MHz	78
3C87-25	For 386 up to 25 MHz	76
3C87-33	For 386 up to 33 MHz	79
3C87-40	For 386 up to 40 MHz	101

**NOW EVEN LOWER PRICES!**

## MEMORY MODULES

256KX9-80	256K x 9-80 NS SIMM	\$12.00
256KX9-80SP	256K x 9-80 NS SIPP	12.50
256KX9-70	256K x 9-70 NS SIMM	13.00
1MEGX9-80	1MB x 9-80 NS SIMM	35.00
1MEGX9-80SP	1MB x 9-80 NS SIPP	39.00
1MEGX9-70	1MB x 9-70 NS SIMM	38.00
1MEGX9-70SP	1MB x 9-70 NS SIPP	39.50
1MEGX9-60	1MB x 9-60 NS SIMM	39.50
4MEGX9-60	4MB x 60 NS SIMM	143.00

## DISK DRIVES

DDD-04	5 1/4 inch DSDD 360K black faceplate	\$59
DDD-05	5 1/4 inch DSDD 360K beige faceplate	59
DDH-06	5 1/4 inch DSHD 1.2MB beige faceplate	59
DDH-09	3 1/2 inch 720K beige w/bracket	59
DDH-10	3 1/2 inch 1.44MB beige w/bracket	59
DDH-11	Same as DDH-10 without 5-1/4" Mounting bracket. Fits in 3-1/2" bay	55

### 3-1/2" Drive Mounting Kits \$9.95

5.25KITFD Mounts 3-1/2" Floppy drive in 5-1/4" Bay  
5.25KITHD Mounts 3-1/2" Hard drive in 5-1/4" Bay

## HARD DRIVES

ST-351A	40MB, 28MS IDE, 3-1/2"	\$209
ST-3120A	105MB, 15MS IDE, 3-1/2"	\$319
ST-3144A	120MB, 19MS IDE, 3-1/2"	\$359
ST-1239A	210MB, 15MS IDE, 3-1/2"	\$639
<b>SCSI Hard Drives</b>		
ST-1239N	Seagate 204MEG, SCSI, 15MS, 3-1/2"	\$649
ST1480N	Seagate 426MEG, SCSI, 14MS, 3-1/2"	\$1399
ST-41650N	Seagate 1.4GB, SCSI, 15MS, FH	\$2479
<b>MFM Hard Drive</b>		
ST-251	40MEG Fixed Disk without Controller ST-251, 5-1/4"	\$259

Locations in San Antonio • Austin • Dallas

**1 (800) 531-5369**

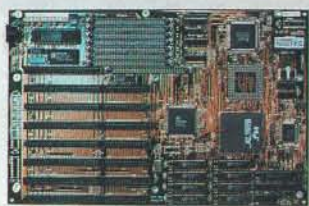
11342 IH 35 NORTH • SAN ANTONIO, TEXAS 78233

(512) 637-3200

Hours: 7am-8pm Monday-Friday • 9am-5pm Saturday CST • FAX: (512) 637-3264



## MOTHERBOARDS



Part#	Description	Each
MB286-16	16 MHz 286 Motherboard	\$85
MB286-20	20 MHz 286 Motherboard	\$95
MB386SX-25	25MHz 386 Motherboard	\$159
MB386-33C	33MHz 386 Motherboard	\$229
MB486-33	33MHz 486 Motherboard	\$579

Descriptions and Prices on Mother Boards  
Subject to Change.

## EXPANSION BOARDS

Part#	Description	Each
IFC-12	Serial Board PC/XT	\$11
IFC-25	2 Serial, Parallel, Game Board XT/AT	\$16
IFC-13	Parallel Board XT/AT	\$9
IFC-20	Game Board XT/AT 2 Ports	\$9
IFC-70	BOCA 2 Serial, 2 Parallel I/O Board	\$49

## DISK CONTROLLER BOARDS

Part#	Description	Each
IFC-14	2 Floppy Controller Board PC/XT	\$13
IFC-15	Disk I/O Board Serial, Parallel, Clock, Game PC/XT	\$25
IFC-24	Fixed Disk MFM/2 Floppy Controller AT	\$69
IFC-27-2	AT 2/IDE 2/Floppy Controller	\$19
IFC-28	Fixed Disk Controller Board PC/XT	\$47
	XT MFM hard drive controller board.	
ST-01	8-Bit SCSI Controller Board	\$29
ST-02	8-Bit SCSI/Floppy Controller Board	\$47
IN-2000	16-Bit SCSI Hard/Floppy Controller Board	\$189

## POWER SUPPLIES

Part#	Description	Each
PS-150	150 watt XT Power Supply	\$39
PS-200M	200 watt XT power Supply	49
PS-200	200 watt AT Power Supply	59
PS-230	230 watt Large Vertical Case	79
PS-200MINI	200 watt Baby Vertical Case	59

## KEYBOARDS

KBY-60	AT Style - LIMITED QUANTITIES	\$19
	AT style, 10 function keys. XT or AT	
K-156	Enhanced Style Keyboard (XT,AT)	\$35
	101 keys with regular footprint for XT or AT.	
	Size: 20 1/2"L x 7 7/8"W x 1 13/16"H.	
K-160	Enhanced Style Narrow Footprint	\$36
	Small footprint keyboard with 101 keys and three cable position connection to computer (left, center, right) for XT or AT. Size: 18 1/2"L x 6 1/2"W x 1 5/16"H.	
K-158	Enhanced Style Small Footprint	\$43
	Compact keyboards with 101/102 keys. 22 percent smaller than regular footprint. Size: 15 3/4"L x 7 7/8"W x 1 13/16"H.	
K-158-1	Small Footprint Spanish Language	\$47
KBY-39	Enhanced Style, 12 Function Keys, XT or AT	\$49
KBY-TRACK	Keyboard/Trackball	\$79
	Keyboard with 12 Function Keys and Trackball. Microsoft compatible driver on a 5.25" disk. User selectable XT or AT, 386 or compatible.	

## BOCA I/O 2 BY 4

A High-Performance Interface Solution

- Supports 4 serial ports and 2 parallel ports. Parallel Port: LPT1, LPT2, Selectable interrupts: IRQ 5 and 7. Serial Port: COM 1-4, Selectable interrupts: IRQ 2, 3, 4 and 5
- Comes with two DB-37 to DB-25 cable adapters and one DB-37 connector/bracket assembly with ribbon cable
- Made in the USA
- 5-year warranty
- Free technical support
- FIFO Buffering

**BOCA**  
RESEARCH INC



IO2BY4 BOCA I/O 2 by 4 \$109

## PARALLEL PRINTER CABLES



These parallel cables are standard DB-25 to Centronics. They are fully shielded and have thumbscrews for easy installation.

Part#	Description	Each
PPC301-6	DB25-36P 6 ft.	\$2.99
PPC301-6RA	DB25-36P 6 ft. (Rt. angle)	4.99
PPC301-10	DB25-36P 10 ft.	3.99
PPC301-10RA	DB25-36P 10 ft. (Rt. angle)	5.99
PPC301-15	DB25-36P 15 ft.	4.99
PPC301-20	DB25-36P 20 ft.	5.99
PPC301-25	DB25-36P 25 ft.	6.99

## DB-25 25 LINE CABLES

These DB-25 cables are all lines wired straight through. They are fully shielded and come with thumbscrews for easy installation.

Male to Male			Male to Female		
Part#	Desc.	Each	Part#	Desc.	Each
25MM-6	6 ft.	\$3.99	25MF-6	6 ft.	\$3.99
25MM-10	10 ft.	4.99	25MF-10	10 ft.	4.99
25MM-15	15 ft.	6.99	25MF-15	15 ft.	6.99
25MM-20	20 ft.	7.99	25MF-20	20 ft.	7.99
25MM-25	25 ft.	8.99	25MF-25	25 ft.	8.99
25MM-50	50 ft.	16.99	25MF-50	50 ft.	16.99
25MM-100	100 ft.	32.99	25MF-100	100 ft.	32.99

## DB-25 25 LINE SWITCHBOXES

Part#	Description	Each
AB25-2E	2 Way Economy	9.99
AB25-3E	3 Way Economy	13.99
AB25-4E	4 Way Economy	15.99
AB25-5E	5 Way Economy	23.99
AB25-XE	X-Over Economy	16.99

## DB-25 TO CENTRONICS SWITCHBOX

Part#	Description	Each
AB252-36E	2, DB-25 connectors to Centronics connector	\$18.99

## PARALLEL LINE EXTENDERS



- Transmission distances up to 1200 feet
- Uses a simple 2 or 4-conductor cable with RJ-11 plugs
- No external power supply required
- Uses differential voltage signal for long distance transmission to guarantee good immunity to common mode noise
- The Transmitter and Receiver plug directly into your equipment to avoid additional cables

Part#	Description	Each
PLE100	DB25 Male to DB25 Male with 50 Ft. of cable	\$59.95
PLE110	DB25 Male to Centronics 36 Pin Male with 50 Ft. of cable	\$59.95

## BNC CABLE ASSEMBLIES

### Ethernet BNC Cables

Part#	Description	Each
58BC-10	RG-58 male-to-Male 10 ft.	\$4.59
58BC-25	RG-58 Male-to-Male 25 ft.	6.79
58BC-50	RG-58 Male-to-Male 50 ft.	8.89

### Arcnet BNC Cables

Part#	Description	Each
62BC-10	RG-62 Male-to-Male 10 ft.	\$6.89
62BC-25	RG-62 Male-to-Male 25 ft.	9.39
62BC-50	RG-62 Male to Male 50 ft.	13.89



## NEW PRICES - NEW PRODUCTS NEW FALL FLYER! CALL NOW! 1 (800) 531-5369

**TERMS:** No surcharge on credit cards. For C.O.D. orders add \$5. C.O.D. orders are cash or cashiers check only. Minimum C.O.D. order is \$25. P.O.'s accepted from approved accounts. Government, Institutional and Corporate Purchase Orders welcome. FAX your order for faster service. All orders under \$99 will be assessed a \$3 handling fee. Orders of \$99 or more, no handling charges. All shipping is FOB San Antonio, Texas and will be added to invoice. Texas residents add 8.14% sales tax. All returns require an RMA number and we ask that all returns are sent back in the condition in which you received them. A 15% restocking fee will be assessed on product that is returned in non-resaleable condition. Prices are subject to change, please call for current pricing. We are not responsible for typographical errors. In a hurry? Federal Express your order. 2nd Day Economy: \$6.75 up to 20 lbs. Overnight Priority: \$15.50 up to 20 lbs.

**VOLUME DISCOUNT  
PRICES!**

**FEDERAL  
EXPRESS**



11342 IH 35 NORTH • SAN ANTONIO, TEXAS 78233 (512) 637-3200  
Hours: 7am-8pm Monday-Friday • 9am-5pm Saturday CST • FAX: (512) 637-3264

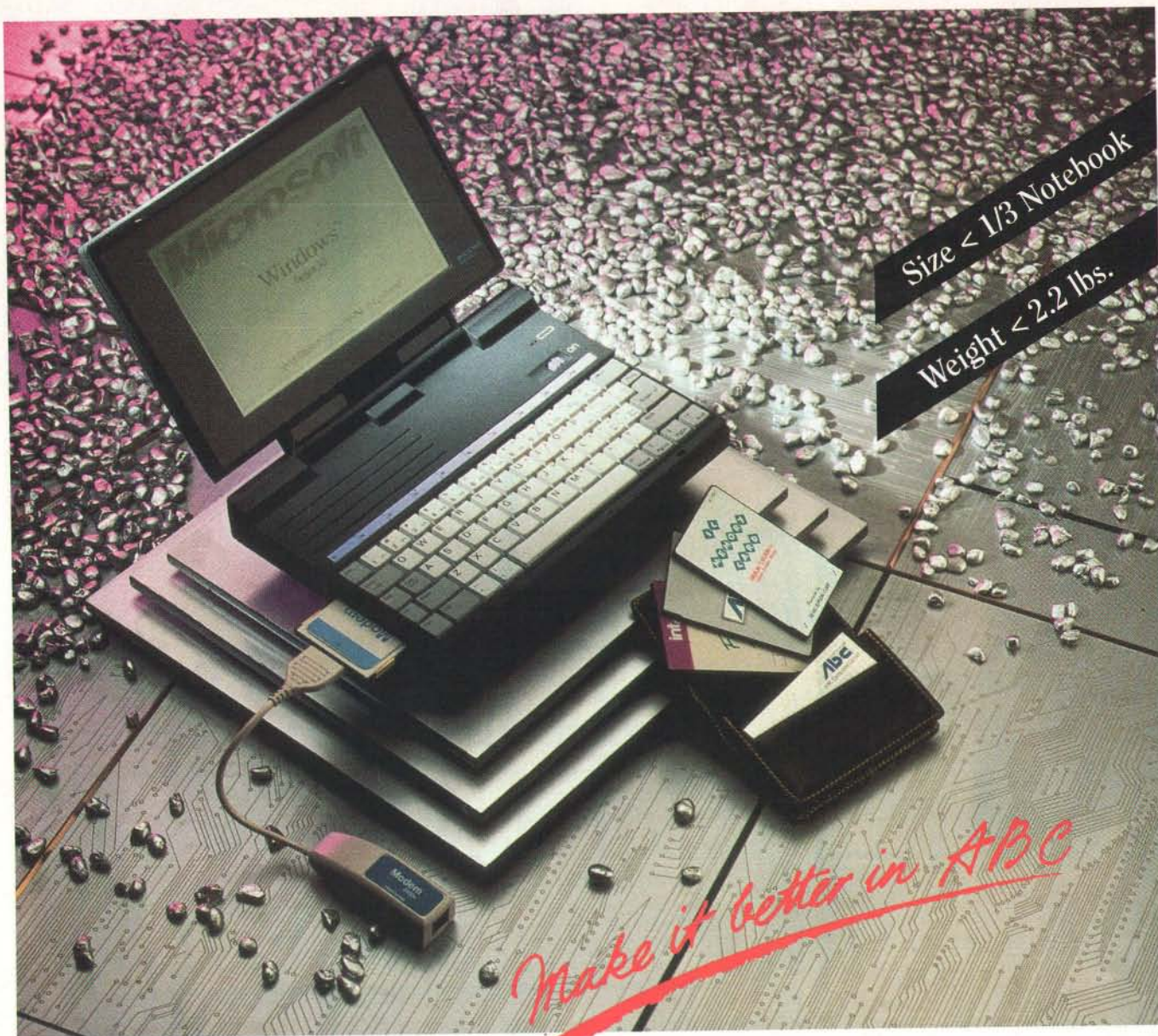
**1 (800) 531-5369**





# The New Definition of Notebook

# BICOM B260i



Size < 1/3 Notebook

Weight < 2.2 lbs.

*Make it better in ABC*

30-Day Money Back Guarantee  
\$100 Rebate for the first 50 Customers

**ABC** COMPUTERS®



1-800-336-2280

ABC Computer (USA) Corp.  
2531 237th Street, Suite 122, Torrance CA 90505  
310-325-4005 Fax 310-325-6369

See us at  
**COMDEX/Fall '92**  
Booth 5674

- Weight 2.2 lbs. (Bicom and Battery)
- Dimension 8.78" x 6.36" x 1.22"
- True 16 bit AMD Lonestar Processor, 386SX Class Performance
- 5 "AA" size NiMH Batteries, 4-hour operation\*
- 60 MB Hard Disk Drive
- 2MB RAM expandable to 4MB on board and 16MB with memory card
- PCMCIA 2.0/JEIDA standard port for memory card and I/O card
- 640 x 400 resolution LCD screen supports CGA, AT&T mode and all Windows graphics
- 64-key keyboard
- 1 parallel (bi-directional)/ 1 serial
- External FDD port for optional Floppy Drive
- DR-DOS 6.0, File Transfer Software & Serial Download Cable
- Built-in Personal Data Manager software
- Built-in Programmable Power Management Software
- Universal AC/DC adaptor
- Carrying Case

**\$1250**

Options: External Floppy Drive, SRAM Memory Cards, 2400bps IC Card Modem, extra batteries

Circle 259 on Inquiry Card (RESELLERS: 260).

\*Battery life is measured with power management enabled.  
All brand names are registered trademarks of their respective owners.



# THIS IS ONE FLIGHT YOU DEFINITELY WON'T BE SLEEPING THROUGH.



So the novelty of flying wore off a long time ago. Cancel those reservations and strap yourself into the cockpit of the *F-15 Strike Eagle® III* jet fighter computer game. This is

flying as it should be. Slicing through war theaters around the world. Blasting enemy fighters to smithereens with high-tech missiles.

Devastating strategic targets in dangerous bombing runs.

Performing fantastic aerial aerobics.

And dogfighting against a friend via modem. All brought to life by dazzling, state-of-the-art graphics. Sure, it's not like flying first class.

But when's the last time you had fun flying first class?

*F-15 Strike Eagle III* from MicroProse.

To get your copy, visit your favorite computer game retailer today.

**MICROPROSE™**  
ENTERTAINMENT • SOFTWARE  
**SERIOUSLY FUN SOFTWARE**

To get our free catalog, call **1-800-879-PLAY** (Mon. - Fri., 8:30 am - 5:00 pm EST) or fill out the coupon and mail it to: MicroProse Software, Inc. 180 Lakefront Drive Dept. D10 • Hunt Valley, MD 21030-2245

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone ( ) \_\_\_\_\_

**NAB**

© 1992 MicroProse Software, Inc. ALL RIGHTS RESERVED.  
Available for IBM-PC/Compatibles.



# How Can I Have

## SYSTEMS

### ALL SYSTEMS INCLUDE:

- 4MB RAM on 32MB Motherboard
- 2 Serial, 1 Parallel, 1 Game Port
- 2 Floppies, 1.44 & 1.2 MB (3-1/2" & 5-1/4")
- DynamicScan, Super VGA Monitor .28 DOT, 1024x768, Tilt & Swivel
- 1MB, Super VGA Card
- 101 Keyboard, Non-Click or Click
- Min. 200W Noiseless Power Supply
- 8 Expansion Slot
- Windows 3.1 and Mouse (2600DPI), DOS 5.0

Synchronous 32Bit Super VGA Card  
50 MHZ or 33MHZ

- 486-50MHZ, 256K Cache, w/Local Bus .....\$1,589.00
- 486-50MHZ, 256K Cache, w/ISA.....\$1,499.00
- 486-33MHZ, 256K Cache, w/ISA Bus.....\$1,259.00
- 386-40MHZ, 64K Cache, AMI BIOS  
Upgradeable to 486-50MHZ .....\$998.00

### OPTION:

Non Interlaced DynamicScan 72 SPVGA Monitor.  
1024 x 768, .28 DOT, 72HZ, Add.....\$49.00

### HARD DRIVES: – Call For Best Price

80MB	100MB	120MB	200MB	300MB	600MB	1.2GB
14MS	16MS	14MS	14MS	14MS	15MS	14MS

### The Fastest PC. Configurations:

486-50MHZ  
Motherboard  
512k external Cache  
16MB RAM Installed  
Dual Local Buses

32Bit Synchronous  
SuperVGA Card 1MB  
Accelerating  
Windows and  
AutoCAD

IDE 32BIT  
Synchronous  
Local Bus 50MHZ  
w/4MB Cache Card  
Less than .3MS



Dual Synchronous 32Bit 50MHZ Buses  
32Bit VGA Card and 32Bit IDE Local Buses /4MB Caching!

- 300MB IDE Hard Drive plus 32Bit Local Bus
- Comes with 4MB RAM Write Back Cache
- Speed Up Windows or AutoCAD
- 32Bit Local Bus 16115CHR/MS
- 16MB RAM with 512K Write Back S.RAM Cache
- Dual Local Buses



\$3,789.00



- 15" Flat Screen Flicker Free
- .28 DOT, 1024 x 768
- Low Emission

**The Best Application for File Server, CAD Station, Graphic Art Data Base**



- Click or Soft Touch 101 Keyboard

**30 Days Money Back Guarantee  
On site service to Most Locations**



# The Fastest PC?

## MOTHERBOARD

486-50MHZ, Local Bus  
w/S3 VGA Card Set  
.....\$989.00

486-EISAor ISA  
Please CALL

386-40MHZ, 64K  
AMI Bios .....\$229.99

Upgradable to 486-50  
386-40MHZ .....\$279.00

386-SX25MHZ.\$139.00

386-SX16MHZ.\$119.00

## GRAPHIC CARDS

Trident, 1MB.....\$69.00

SpeedStar Stealth,  
1MB .....\$249.00

Renoir Hi Color,  
1MB .....\$189.00

Tseng Lab, 1MB RAM,  
32K Colors.....\$119.00

## FLOPPY DRIVES

Teac 1.44MB.....\$52.00

Teac 1.2MB.....\$58.00

JPN 1.44MB.....\$51.00

JPN 1.2MB.....\$57.00

## HARD DRIVES

Maxtor .....CALL

Seagate .....CALL

Conner .....CALL

Western Digital ....CALL

## CASES & POWER SUPPLIES

AT Mini Tower  
w/200W P.S. ....\$59.00

AT Medium Tower  
w/200W P.S. ....\$89.00

AT Big Tower Case  
w/230W P.S. ....\$129.00

## MONITORS

1024 x768 Non-  
interlaced SuperVGA  
Package \$368

- .28 DOT Pitch
- 16 bit Spvga Card w/  
1MB RAM
- 256 Colors at 1024x768
- 14" Monitor
- Drivers support  
major programs
- Monitor Only \$289

## FAX/MODEM SWITCH

- Save phone line!
  - Does not require  
dedicated line
  - Support FAX/  
Modem/Phone
  - Intelligent Auto  
Switch \$69
- Any Name Brand  
Please Call for the  
best price

## DYNAMICSCAN 486-33MHZ DX NOTEBOOK



- Complete Set  
.....\$2,299.00
- 386-DX 33MHZ w/80MB
- HardDrive...\$1,889.00
- No Hidden Price

## MISCELLANEOUS

Memory.....CALL  
Printers.....CALL  
Any Model  
FAX/Modem .....CALL

We Offer Any Custom Configuration.  
Lanstic. Novell Lan System.

All Systems Include The Following  
Software Package That Even The Novice  
Can Use.

- Easy Menu
- Lotus Tutor
- Bible
- Accounting
- DOS Tutor
- Word Processing
- Data Base
- Real Estate
- Variety of Games and  
Educational Programs

Test a DynamicScan System yourself with  
a 30-day money back guarantee.

With the purchase of any DynamicScan  
System, you will have access to unlimited  
technical support with our "800"  
DynamicScan Users Number.

Warranty-1 Year On-Site Service to most  
locations.

**DynamicScan**  
10824 Page Avenue  
St. Louis, Missouri 63132

**SALES/ORDERS.....314-423-0044**

**FAX .....314-426-4014**

**EXPORTING .....314-428-7734**

**TECH SUPPORT AND RMA  
800-852-3273**





# 16MB TECHNOLOGY NOW!!

ACER 486sx - 16MB SIMM (4M X 36)	\$ 599.00
32MB SIMM (8M X 36)	\$ 1,999.00
COMPAQ SystemPro - 32MB MODULE	\$ 1,599.00
DELL 486's - 16MB KIT (2 SIMMS)	\$ 598.00
32MB KIT (2 SIMMS)	\$ 1,198.00
MAC IIfx - 64MB KIT (4 SIMMS)	\$ 2,116.00
MAC QUADRA 950 - 64MB KIT (4 SIMMS)	\$ 2,076.00
MAC IIfx, IIfcx, QUADRA 900 - 64MB KIT (4 SIMMS)	\$ 2,076.00
MAC QUADRA 700 - 64MB KIT (4 SIMMS)	\$ 2,276.00
SUN IPX, ELC - 16MB SIMM	\$ 499.00

## OTHER MEMORIES AVAILABLE...

IBM		COMPAQ		HP		LAPTOPS	
PS/1 - 2MB	\$ 68	DP 386/20,20E,25 - 1MB	\$ 66	Vectra QS-16 - 2MB KIT	\$ 129	AST EXEC. NB - 4MB	\$ 135
4MB	\$ 149	4MB	\$ 168	4MB KIT	\$ 229	COMPAQ LTE386 - 4MB	\$ 229
M30 - 2MB	\$ 92	DP 386S/16 - 1MB	\$ 66	Vectra 486 - 2MB	\$ 89	SLT386 - 4MB	\$ 168
M50Z,55sx,65sx,70 - 1MB	\$ 45	4MB	\$ 168	4MB	\$ 149	DELL 316,320 LT - 2MB	\$ 99
2MB	\$ 89	DP 286N,386N,S/20 - 4MB	\$ 149	8MB	\$ 299	EVEREX TEMPO - 2MB	\$ 78
M55sx,65sx,70 - 4MB	\$ 149	M-SYSTEMS - 2MB	\$ 89	X-Station 700 Ser. - 2MB	\$ 89	IBM L40sx - 4MB	\$ 160
M70-A21,A61,121 - 2MB	\$ 90	4MB	\$ 149	4MB	\$ 149	MAC POWERBOOK - 2MB	\$ 104
M40sx,35sx - 8MB	\$ 299	8MB	\$ 299	8MB	\$ 299	NEC P.S. 286,386sx - 4MB	\$ 200
M57sx,90,95 - 8MB	\$ 155	DP 386/33,486/25 - 2MB	\$ 96	9000/400f,425f - 8MB KIT	\$ 495	P.S. 386 - 8MB	\$ 429
8MB	\$ 309	SystemPro - 8MB	\$ 315	16MB KIT	\$ 999	P.S. SX/20 - 4MB	\$ 200
M80-Q41 - 1MB	\$ 65	OK Exp. Brd	\$ 335	32MB KIT	\$ 1869	PANASONIC CF170 - 1MB	\$ 55
M80-111,121,311 - 2MB	\$ 99	DP 386S/16 1MB Exp. Brd	\$ 105	9000/425e - 8MB KIT	\$ 428	T.I. TRVL-MT 3000 - 2MB	\$ 80
M80-A21,A31 - 4MB	\$ 195	DP 386/20,20E,25,25E		16MB KIT	\$ 828	TOSHIBA 1000 - 2MB	\$ 108
16-BIT OK Exp. Board	\$ 128	1MB Exp. Board	\$ 105			2000SX - 8MB	\$ 388
32-BIT OK Exp. Board	\$ 155					3200SXC - 4MB	\$ 160
						5200 - 8MB	\$ 315
AST		DELL		APPLE		PRINTERS	
PREM. 386/20C - 1MB KIT	\$ 65	325D,P,333D,P - 1MB	\$ 45	II,SE,SE/30 - 1MB	\$ 32	EPSON 6000 - 4MB	\$ 229
PREM. 386/25 - 1MB	\$ 45	4MB	\$ 149	Classic - 1MB Exp. Board	\$ 54	HP IIP,III,IIID,P - 2MB	\$ 108
PREM. 486/25 - 1MB	\$ 45	420,425,433 - 2MB KIT	\$ 90	SE/30,IIfx,IIfcx,IIfx,LC &		IIfx - 4MB	\$ 135
PREM. II 486 - 1MB	\$ 45	4MB KIT	\$ 178	Quad. 700,900 - 4MB	\$ 115	IBM 4019,4029e - 3.5MB	\$ 140
4MB	\$ 155	8MB KIT	\$ 298	Quad. 700,900 - 32MB KIT	\$ 1120	4029 - 4MB	\$ 135
8MB KIT	\$ 310	450DE,450SE - 2MB KIT	\$ 90	IIfx - 16MB KIT	\$ 499	OKIDATA 400 - 2MB	\$ 129
PREM. II 1MB Exp. Board	\$ 469	4MB KIT	\$ 178	IIfx - 32MB KIT	\$ 1156		
		8MB KIT	\$ 298	Quadra 256K V-RAM	\$ 30		
				LC 512K V-RAM	\$ 47		

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

### OTHER MEMORIES FOR:

ACER, ALTIMA, APPLE, AST, CHAPLET, COMPAQ, DELL, EPSON, EVEREX, HP, LEADING EDGE, IBM, NEC, NCR, OKIDATA, PACKARD-BELL, PANASONIC, PHILIP, SAMPO, SHARP, SILICON GRAPHICS, SUN MICROSYSTEMS, TANDON, TI, TOSHIBA, TULIP AND ZENITH.

## CALL FOR OUR COMPLETE CATALOG

TERMS: C.O.D. CASH, VISA OR MASTERCARD.  
COMPANY AND UNIVERSITY P.O.'S ACCEPTED UPON CREDIT APPROVAL.

414 CLOVERLEAF DR., UNIT B, BALDWIN PARK, CA 91706  
TEL. (818)855-5688 FAX (818)855-5687



ALL PRODUCT NAMES, TRADEMARKS AND REGISTERED TRADEMARKS ARE THE PROPERTY OF THEIR RESPECTIVE COMPANIES.



# Pick A Card

# Volante

Draw  
your  
winning  
card from  
National  
Design's  
**Volante Series**  
of high speed graphics boards.

**PC**  
MAGAZINE  
EDITORS'  
CHOICE

June 25, 1991  
National Volante AT1000

All Volante high speed graphics boards offer:

- Built on ISA, MicroChannel or VME bus
- Video memory upgrades to 4 MB
- Program memory upgrades to 4 MB
- Razor sharp resolutions from 1024x768 up to 1600x1280
- Blazing color selection from 8-bit to 24-bit true color
- Optional TI TMS34082 floating point processor for enhanced 3D acceleration
- Superior speed of the TI TMS34020 graphics engine paired with National Design's advanced ASIC technology
- LIFETIME WARRANTY - no gamble here!

Whether your game is CAD, Microsoft Windows, graphic arts, multi-media or medical imaging, Volante has a card for you at a fraction of the cost charged by the competition.

Call 800-253-8831 now for information  
on the breathtaking Volante series.

Phone: 512-329-5055 Fax: 512-326-6326

Circle 243 on Inquiry Card (RESELLERS: 244).

**NDI**

NATIONAL DESIGN, INC.  
1515 CAPITAL OF TEXAS HWY. SO.  
5TH FLOOR  
AUSTIN, TEXAS 78746

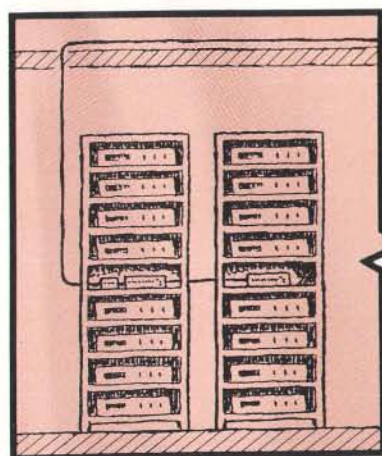
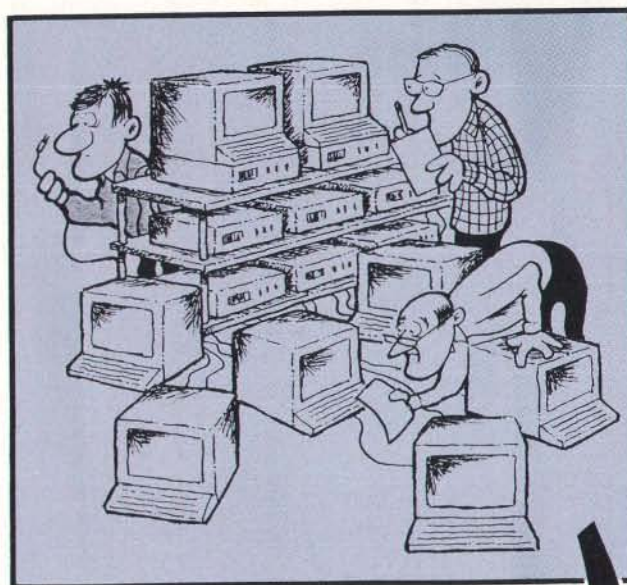


# CONTROL UP TO **96** PC FILE SERVERS WITH **1** KEYBOARD AND MONITOR USING... **COMMANDER**

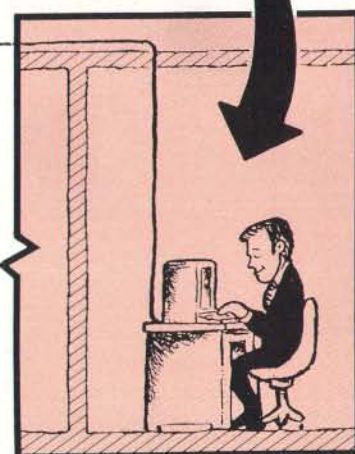
by cybex



- **Select via Keyboard**
- **Dual access up to 250 feet away (optional)**
- **No external power**
- **Mix PC, PC/XT, PC/AT and PS/2**
- **"AutoBoot™" Feature boots attached computers without operator intervention**
- **Shows PC power status**



- **PS/2 Mouse support available**
- **Each unit accommodates from 2 to 8 PCs**
- **Up to 12 units can be cascaded**
- **Mounting kit available for 19" and 24" rack installation**



Dealer Program Available

**Cybex Corporation**

2800-H Bob Wallace Ave.  
Huntsville, Alabama 35805


(205) 534-0011

Fax (205) 534-0010

PC, PC/XT, PC/AT and PS/2 are trademarks of International Business Machines Corp.



# TOWER POWER!



## EISA II 486DX-50MHz System:

- INTEL 486DX-50 MHz CPU with 8K Internal Cache & 487 Math Co-processor
- 256K of External High-speed Cache RAM
- Super Tower Case with 11 Disk Drive Bays, Swivel Door, 300 Watt UL Power Supply & 2 Cooling Fans
- 8MB of High Speed RAM
- 32-bit EISA SCSI-2 Caching Controller with 2MB Cache expandable to 4MB
- 667MB 15ms SCSI-2 Hard Disk
- 1.2 MB & 1.44MB Floppy Disk Drives
- True 32-bit EISA SVGA Adapter w/ Hi-color (32,000+ color capability) & 1MB RAM
- 14" Non-interlaced VESA 72Hz Super VGA Monitor, 0.28dp
- 2 Serial Ports & 1 Parallel Port
- 101-key Mechanical Click Enhanced Keyboard
- 1,600dpi High Resolution 3-button Mouse
- MS DOS 5.0 & Windows 3.1
- One Year On-site Service Included Free

**\$4,695**

## Also Available:

### 486DX-50MHz Local Bus CAD System:

- INTEL 486DX-50MHz CPU
- 8MB RAM, 256K External Cache
- Caching IDE Controller w/2MB Cache
- 210MB 15ms IDE Hard Disk
- 17" Digital 1280 x 1024 SVGA Monitor, 0.26dp
- True 32-bit Local Bus SVGA Adapter w/True color (16.7 million color capability) & 1MB RAM

- Full Tower Case with 300 Watt Power Supply
- 1.2 MB & 1.44MB Floppy Drives
- 2 Serial Ports & 1 Parallel Port
- 101-key Mechanical Click Enhanced Keyboard
- 1,600dpi High Resolution 3-button Mouse
- MS DOS 5.0 & Windows 3.1
- One Year On-site Service Included Free

**\$3,495**

### The ATLAS Commitment:

- 100% Customer satisfaction GUARANTEE • Highest quality products
- Most competitive prices
- Most knowledgeable sales staff • Most responsive technical staff

ATLAS INDUSTRIES, INC.

**1-800-ATLAS-11** (285-2711)

(310)478-6920 FAX (310)479-2334

11601 Wilshire Blvd., Suite 1820, L.A., CA 90025  
Circle 258 on Inquiry Card.



BUY  
HDI



**PC**  
MAGAZINE

EDITORS'  
CHOICE

June 27, 1989  
Mass Storage Mail Order

A RECOGNIZED LEADER!



**Quantum**

**52MB QULPS52A** **IDE**  
17ms 3.5" 1"H  
Bare Drive Kit **\$209**  
8 Bit **\$249**  
16 Bit Kit **\$229**

**120MB QULPS120A** **IDE**  
15ms 3.5" 1"H  
Bare Drive Kit **\$359**  
8 Bit **\$399**  
16 Bit Kit **\$379**

**240MB QULPS240A** **IDE**  
16ms 3.5" 1"H  
Bare Drive Kit **\$649**  
8 Bit **\$689**  
16 Bit Kit **\$669**



**Talon**

**120MB TA3020A** **IDE**  
15ms 3.5" 1"H  
Bare Drive Kit **\$299**  
8 Bit **\$339**  
16 Bit Kit **\$319**

**Maxtor**

**120MB MX7120A** **IDE**  
15ms 3.5" 1"H  
Bare Drive Kit **\$329**  
16 Bit Kit **\$349**

**210MB MX7213A** **IDE**  
15ms 3.5" 1"H  
Bare Drive Kit **\$479**  
16 Bit Kit **\$499**

**Insight**

# HARD DRIVES AND PERIPHERALS

NEW  
LOWER  
PRICES

**WORRY-FREE**  
**30**  
**ONE YEAR REPLACEMENT**  
**Day**  
**GUARANTEE**

**FOR THE BEST  
PRICE, SERVICE  
& SUPPORT  
CALL:**

**800/998-8040**

HDI SALES: 602/350-1128  
FAX 602/350-1150

NATIONAL ACCOUNTS  
Purchase Orders  
800/998-8014  
FAX 602/350-1180

International: 602/350-1144  
FAX 602/350-1188

AP0/FPO: 602/350-1145

Order Status: 800/729-4490

**TOLL-FREE  
TECHNICAL  
SUPPORT**

**WE SHIP VIA  
FEDERAL EXPRESS**

**80% OF ORDERS  
DELIVERED NEXT DAY!**

**INTRODUCING THE  
INSIGHT CREDIT CARD**  
CALL FOR DETAILS  
800/755-0822



**NEVER A SURCHARGE  
FOR CREDIT CARDS**



Prices and availability subject to change without notice. All items NEW. PO's accepted from qualified buyers. Net 20. APO/FPO orders add \$16 shipping. 30 Day Guarantee & 1-Year Replacement Policy may have some restrictions. Shipping is not refundable. All trademarks are the properties of their respective owners. 9.92

Hard Drives International  
1912 W. 4th St., Dept. HAS  
Tempe, AZ 85281

**ORDER  
24  
HOURS  
EVERY DAY**

**Seagate**

**42MB ST351A** **IDE**  
28ms 3.5" 1"H  
Bare Drive Kit **\$189**  
8 Bit Kit **\$219**  
16 Bit Kit **\$199**

**65MB ST277R-1** **RLL**  
28ms 5.25" HH  
Bare Drive Kit **\$219**  
8 Bit Kit **\$279**  
16 Bit Kit **\$299**

**106MB ST3120A** **IDE**  
18ms 3.5" 1"H  
Bare Drive Kit **\$299**  
8 Bit Kit **\$339**  
16 Bit Kit **\$319**

**130MB ST3144A** **IDE**  
16ms 3.5" 1"H  
Bare Drive Kit **\$329**  
8 Bit **\$369**  
16 Bit Kit **\$349**

**245MB ST3283A** **IDE**  
12ms 3.5" 1"H  
Bare Drive Kit **\$599**  
16 Bit Kit **\$619**



**FUJITSU**

**425MB FJ2623S** **SCSI**  
12ms 3.5" HH  
Bare Drive Kit **\$1049**  
16 Bit Kit **\$1199**

**510MB FJ2624A** **IDE**  
12ms 3.5" HH  
Bare Drive Kit **\$1149**  
16 Bit Kit **\$1169**

**520MB FJ2624S** **SCSI**  
12ms 3.5" 1"H  
Bare Drive Kit **\$1149**  
16 Bit Kit **\$1299**

**MICROPOLIS**

**340MB MC1684-7** **ESDI**  
15ms 5.25" HH  
Bare Drive Kit **\$1099**  
16 Bit Kit **\$1249**

**660MB MC1624** **SCSI**  
15ms 5.25" FH  
Bare Drive Kit **\$1369**  
16 Bit Kit **\$1519**

**1049MB HS MC1598** **SCSI**  
14ms 5.25" FH  
Bare Drive Kit **\$1899**  
16 Bit Kit **\$2049**

**1354MB HS MC1528-15** **SCSI**  
14ms 5.25" FH  
Bare Drive Kit **\$2179**  
16 Bit Kit **\$2329**

**CONNER**

**40MB CP3000** **IDE**  
25ms 3.5" 1"H  
Bare Drive Kit **\$189**  
8 Bit Kit **\$229**  
16 Bit Kit **\$209**

**170MB CP30174** **IDE**  
17ms 3.5" 1"H  
Bare Drive Kit **\$399**  
8 Bit Kit **\$439**  
16 Bit Kit **\$419**

**209MB CP3204** **IDE**  
16ms 3.5" HH  
Bare Drive Kit **\$529**  
16 Bit Kit **\$549**

**SIMM**

**ADD 1MB RAM  
AS LOW AS \$39**

**1MB x9 80ns \$38**  
**1MB x8 80ns \$39**

MEMORY FOR EVERY SYSTEM!

**CD-ROM DRIVES**

**SONY**

INTERNAL  
**\$399**

**ALL BARE DRIVE KITS INCLUDE**  
All mounting hardware, "Disk Manager" formatting/partitioning software if necessary, and HD's Hard Drive Reference Manual with complete installation instructions.

**ALL 8 & 16 BIT KITS INCLUDE**  
16-Bit host adaptor hard/floppy "1 to 1" controller or interface card, mounting kit (3.5" kit inc. beige & black bezels), rails, cables, all mounting hardware, "Disk Manager" software (if applicable) and manual.

**COMPLETE INSTRUCTIONS - EVERYTHING YOU NEED!**

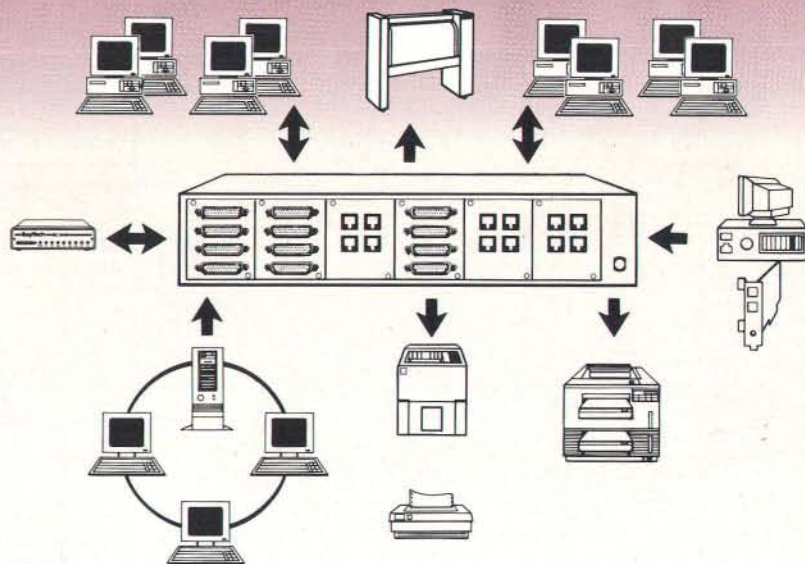
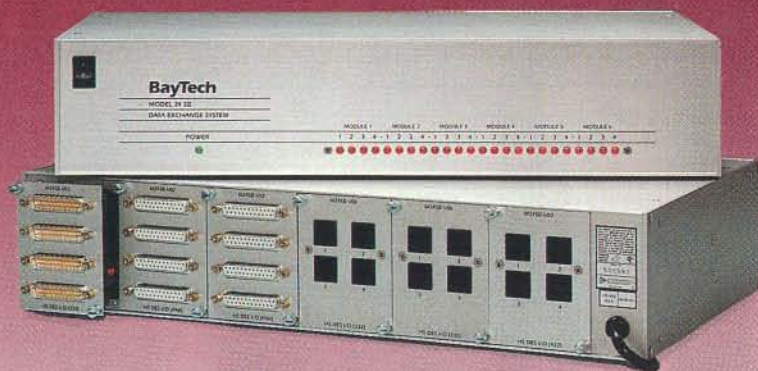
**HARD DRIVES International**  
**800/998-8040**

PURCHASE ORDERS/NATIONAL ACCOUNTS 800/998-8014

**HARD DRIVES**  
International



# PRINTER SHARING THAT MAXIMIZES YOUR HIGH SPEED PCS AND PRINTERS



## Outstanding Features:

- 5.5 M bps total throughput speeds
- Up to 60,000 character per second parallel communications
- 46,000 character per second serial communications (printer sharing)
- Use with BayTech Tran-x parallel extension products for data transmission to 46,000 characters per second over 1000+ feet
- Expandable up to 24 ports
- Up to 16MB dynamically allocated buffer
- Full duplex communication at 115.2k baud for high speed file transfer
- Device selection while in Windows® or graphics programs

**T**he Model 24SII Data Exchange System (DES), with total throughput speed exceeding 5.5M bits per second, is the answer to your need for the fastest, cost effective peripheral sharing available.

These high speeds allow computers and file servers to off-load large text and graphic files to plotters, modems, printers, and other computers at extremely fast rates.

With more than 1.5 million connections, BayTech has been serving customers worldwide for over 16 years. For high speed data communications, contact a BayTech representative *today!*

Because Resources Should Be Shared



Data Communications Products Division  
200 N. Second Street, P.O. Box 387  
Bay St. Louis, MS 39520

Fax: 601-467-4551 Phone 601-467-8231 or toll-free

**800-523-2702**

All products or company names are trademarks of their respective holders.



Ask for  
your copy of  
the ACP  
Computer  
Hotline

# ACP-The Superstore with Super Deals!

## Hard Drives

**Western Digital**  
High performance  
"Caviar" series with 1" height, Cache Flow™ and 32K buffer.  
AC280 80Mb 1" 3.5" 14ms IDE ..... Call  
AC2120 125Mb 1" 3.5" 14ms IDE ..... Call  
AC2200 200Mb 1" 3.5" 14ms IDE ..... Call

**Maxtor**  
7080A 80Mb 1" 3.5" 15ms IDE ..... Call  
7120A 120Mb 1" 3.5" 15ms IDE ..... Call  
LX213A 213Mb 1" 3.5" 15ms IDE ..... Call  
MX1240 1.2Gb 1" 3.5" 15ms IDE ..... Call  
Call for 1.2Gb SCSI Panther 1.7Gb Call

**Conner Peripherals**  
30104 120Mb 3.5" 19ms IDE ..... Call  
3204 200Mb 3.5" 16ms IDE ..... Call

Call for  
Quantum, Micropolis, Seagate. Also  
controllers from Ultrastar, Always, WD etc.

## Backups

**Colorado**  
DJ10 120Mb Tape Drive internal ..... 199  
DJ20 250Mb Tape Drive internal ..... 268  
QFA700 700Mb Tape Drive internal ..... 779

**Syquest (with cartridge)**  
44Mb kit S0555, S0400, S001 (16 bit) ..... 419  
44Mb external ..... 499  
88Mb kit S05110, S0800, S001 (16 bit) 529  
88Mb external ..... 629

**GrassRoots Floptical**  
Floptical 21 Mb (external) ..... Call  
Floptical 21 Mb (internal) ..... Call

## Floppy Disk Drives

**Toshiba**  
ND04DG 360K 5.25" HH PC/XT ..... 59  
ND08DEG 1.2Mb 5.25" HH PC/AT ..... 72  
AC3551GR 1.44Mb 3.5" HH w/AT Kit ..... 72

**Apple**  
1.2 Mb 5.25" ..... 66 2.88Mb 3.5" ..... Call  
1.44Mb 3.5" ..... 67 All in One 3.5/5.25 149  
Compaq 1.3/1.44 Floppy ..... Call

## MultiMedia

**Sony**  
7205 CD Laser Library w/six CD's ..... 499

**Creative Labs**  
Complete all-in-one MPC compatible  
upgrade kit includes: Panasonic CD Drive,  
Sound Blaster Pro, five CD's, Microsoft  
Multimedia Windows, Bookshelf,  
Hyperglide, Games, drivers, cables,  
connectors and more.  
Multimedia Kit Int/Ext ..... 539/599  
Sound Blaster Reg/Pro ..... 109/199

**MediaVision**  
CDPC Subsystem (external) ..... 1079  
Pro 16 Multimedia System ..... 1019  
Pro Spectrum Audio Plus ..... 799

**NEC Technologies**  
CDR 7A (ext) w/interface (280ms) ..... 445  
CDR 37 (ext) w/interface (450ms) ..... 455

## Input Devices

ACP 3-button Mouse (limited supply) 14.95  
CH Products Flightstick ..... 49  
Mouseman Combo/Cordless ..... 75/88  
Logitech Trackman serial/bus ..... 69/72  
Logitech Trackman Portable ..... 104  
Logitech Fatman ..... 599  
Microspeed PC-Trac ser/bus ..... 79/89

## Video Graphics Cards

**ATI**  
Graphics Ultra w/1Mb ..... 399  
Graphics Vantage w/1Mb ..... 279  
VGA Wonder LX24 w/1Mb ..... 169  
VGA Stereo FX ..... 219

**Diamond**  
SpeedSTAR Stealth w/1Mb ..... 265

**Orchid**  
Fahrenheit 1280 w/1Mb ..... 275

**Paradise**  
Windows Accelerator w/1Mb ..... 245

**PC'S BELOW COST!**  
**286/12 \$269**  
80286/12 CPU • 3.5" Floppy • 1 Mb  
101 Keyboard • Monitor Extra

**CPI Modem \$45<sup>95</sup>**  
**Bundle**  
2400 Baud, FREE Prodigy Software  
Free software gets you on-line fast!

## Chips and SIMM's

**RAM Chips**  
41256-100 256K 100ns DIP ..... 1.49 ..... 1.35  
41256-80 256K 80ns DIP ..... 1.59 ..... 1.49  
41256-60 256K 60ns DIP ..... 4.79 ..... 4.59  
1Mb-100 1Mb x 1 100ns DIP ..... 4.05 ..... 3.95  
1Mb-80 1Mb x 1 80ns DIP ..... 4.49 ..... 4.39

Call for VIDEO RAMS & CACHE RAMS  
Over 20,000,000 IC's in-stock including  
We specialize in 486DX/25 & 33 Upgrades

**New Low Prices!**  
**SIMM Modules**  
421000A9B-80 1Mb x 9 80ns ..... 37.95 ..... 32.95  
421000A9B-70 1Mb x 9 70ns ..... 39.95 ..... 35.95  
424000A9B-80 4Mb x 9 80ns ..... 125 ..... 114  
424000A9B-70 4Mb x 9 70ns ..... 125 ..... 117  
41256A9B-80 256K x 9 80ns ..... 9.95  
421000A8B-80 1Mb x 8 80ns ..... 34.95 ..... 31.95  
424000A8B-80 4Mb x 8 80ns ..... 117 ..... 105

## Math Coprocessors

**AMD 80C287** ..... increase your 286 PC  
performance, 80C287-10 ..... \$59.95

**IBM 8087** Genuine w/manual ..... \$29.95

Intel "OverDrive" - Reduced! ..... Call

**80287's**  
80287-10 ..... 89 80387SX-16 ..... 69  
80287-20 ..... 79 80387SX-25 ..... 79  
80287XL ..... 88 80387SX-33 ..... 99  
**80387's**  
80387DX-16 ..... 79 80487SX-16 ..... 469  
80387DX-20/25/33 95 80487SX-25 ..... 489  
80387DX-40 ..... 119 80487SX-25 ..... 489  
80387SL ..... 99 RapidCad ..... 269

## Memory Upgrades

**Notebooks**  
Compaq Lite, 4Mb ..... \$239  
HP 95LX, 2Mb ..... 479  
IBM L40SX, 8Mb ..... 329  
Everex Carrier, 2Mb ..... 129  
NEC UltraLite SL/20, 6Mb 599  
Piquet Palmtop, 2Mb ..... 599  
T2000SX, 8Mb ..... 399  
T3300SL, 6Mb ..... 319

**Laser Printers - "O"K Boards**  
HP III/IIIi/IIIp/IIIp+/IIIi/IIIi ..... 49.95  
Panasonic 4410/30 or 4420/10 ..... 69.95/49.95  
Oki 400 ..... 49.95 Oki 800/20 ..... 59.95  
Oki 830/40 79.95 IBM 4019/29 ..... 49.95  
NEC ..... 69.95 QMS 410 ..... 69.95

**Computer Upgrades**  
AST Premium 386/25.33 SX16/20 ..... Call  
Compaq DP386/33, 486/33 SysPro ..... Call  
IBM 30-286 ..... #30F5360 2Mb ..... Call  
IBM 35.40.55sx.65.70 #6450604 2Mb ..... Call  
IBM 90.95.P75 #6450902 2Mb ..... Call  
Call for NEC, HP, Zenith, Leading Edge.

**CO STAR**  
the  
**AddressWriter™**  
The first printer specifically designed  
to print envelopes, postcards and  
labels. Great for the office. Time  
saver, plus it received the "Industrial  
Design Excellence Award".  
for PC and MAC only ..... \$449  
LabelWriter II PC ..... \$189  
LabelWriter II Plus ..... \$299

**66 MHz ISA**  
**Micronix**  
**\$1399**  
Yes, the strongest  
engineering board  
manufacturer has  
just released a 66 MHz  
DX2 ISA Motherboard.  
Gemini chipset, 256K external  
cache, Baby AT, expandable to  
32 Mb, Phoenix BIOS and 8 slots!  
**Micronix**  
486DX2/66MHz w/256K cache \$1399  
486DX2/50MHz w/256 cache ..... 999  
486DX/50 EISA w/256K cache ..... 1599  
486DX/33 w/256K cache ..... 749  
486DX/50 ISA w/256K cache ..... 1299

**After Dark**  
**2.0 for Windows**  
Prevents screen  
burn-in. Automatic  
display of animated  
screen art of over  
40 incredible and  
novel scenes. Flying  
toasters, exotic  
tropical fish ... or use  
your own logo. With  
SOUND PALETTE™  
digital sound effects  
for bubbling fish  
tanks, etc....  
**29<sup>95</sup>**

**SII**  
**CMi 450**  
New low price on  
an incredibly sharp  
SVGA flicker-free,  
non-interlaced multi-scanning  
monitor. Features finest quality  
Trinitron high-contrast black tube.  
25mm aperture grille and  
1024x768 resolution.  
CM1450 14" ..... \$499  
CM1760 17" (25mm) ..... 1149  
or try Seiko's new 20"  
CM 2070 LR 20" ..... 2449

## Advanced Computers • with AMD High Performance CPU's • plus SEIKO Trinitron Monitors

**SII** • all Advanced Systems include:  
• OPTI or ACC Chips • 1 Year Warranty  
• AMI BIOS • Enhanced 101 Keyboard  
• IDE Interface • Free Accounting Software  
PLUS Motherboards manufactured in the USA!!

COMPUTER	386SX/33	386DX/40	486SX/25	486DX/50
CPU	AMD	AMD	INTEL	INTEL
RAM	2 MB	2 MB	2 MB	4 MB
FLOPPY	5.25 or 3.5"	5.25 or 3.5"	5.25 or 3.5"	5.25 or 3.5"
BIOS/Chipset	AMI/CPTT	AMI/CPTT	AMI/ACC	AMI/ACC
CACHE	32 K	64 K	8 K (int.)	64 K
ACP Price	529.	699.	679.	1299.
Price w/Seiko SVGA & card	1049.	1219.	1119.	1819.

\* Price with SEIKO 1450 SVGA Monitor and 1024x768 Card  
Call for hard drive, Tower, Mini-Tower and other configurations.

**Leading Edge 386SL-25MHz Notebook Computers**  
• Low Power Designs plus SCSI-2  
• 2 Mb RAM expand up to 10 Mb  
• VGA-64 shades • Mouse  
**60Mb w/32k Cache.....Call**  
**New! Color 386SL Notebooks**  
**60Mb and 80Mb.....Call ACP!**

**Call ACP for Notebooks... AST COMPAQ MITAC TOSHIBA**  
**386/SX20 Notebook**  
1 Mb RAM • 3.5" Floppy  
30 or 60 Mb Hard Drive  
5.8 lbs. • VGA LCD  
**\$1099**  
with 30 Mb

**Software Special Purchase...up to 90% Off!**  
**35,000 Packages in stock! Volume discounts-Call**  
**Call for a complete list...**  
Product Title ..... Price  
Puzzle Master ..... 14.95  
Electric Jigsaw Puzzle ..... 9.95  
Dvorak on Typing ..... 12.95  
Coinbase 4.0 ..... 19.95  
The Sky ..... 19.95  
Flowers ..... 24.95  
Trees ..... 24.95  
Bugs ..... 29.95  
MindViewer ..... 29.95  
Double DOS ..... 14.95  
Switch II ..... 14.95  
Hotline ..... 19.95  
Eye Relief ..... 99.95  
ResumeMate /5.25 ..... 9.95  
Flex Forms (Corp.) ..... 19.95  
Timeslips ..... 19.95  
100's More to choose!! ...

**Norton AntiVirus v2.0**  
The perfect  
antidote for your  
infected systems plus on-going  
preventative care. Includes Norton's  
24-hour Virus FAX-Line for updates  
when new viruses appear.  
**Symantec Q&A Database v4.0 \$229**  
ACP Price only.....

**Hayes Optima Modem**  
New from Hayes, an affordable high  
performance modem with V.42  
speed and throughput up to 9600  
baud. Includes SmartCom EZ.  
Optima 24 2400 baud ..... \$149  
Optima 96 2400 baud ..... \$369  
Ultra 144 w/Express 96 ..... \$679

**PC6781 SHARP 386SL Note Book**  
• Weighs  
Only  
4.9 LBS.!  
• 386SL/20  
with 2Mb  
• 80Mb Internal  
Hard Drive  
• Built-in  
Trackball  
• IC Card Slot  
**\$1995**

**MINUTEMAN**  
**Minuteman UPS**  
**ACP Price \$379**  
• 2 ms. Transfer, 600 VA  
• LAN Comm Port  
• 2 Year Warranty  
Reg. Retail \$579.



**Advanced Computer Products, Inc.**  
1310 E. Edinger, Santa Ana, CA 92705 • FAX 714-558-8849 • Toll-Free 1-800-FONE ACP • Sales 714-558-8813

No surcharge on credit card. Credit cards not charged until we ship. 100% risk free return guarantee! If you are not 100% satisfied just return insured within 15 days complete with all materials in new resalable condition with original invoice. ACP will immediately exchange product or issue ACP credit less shipping for future purchase. Prices subject to change without notice. No Returns on software Special Purchase

CALL 1-800-FONE-ACP TOLL-FREE ORDERS



# MEMORY ... YOU JUST CAN'T DO WITHOUT IT.

## Picture this:

You bought a new software package. You try it out on your computer and soon find yourself working for hours on a sophisticated graphic design. While scrolling through your worksheet, it feels like you are moving through pudding. Your hard disk has a tough time trying to catch up. You then try to print, but the laser printer's buffer is full. You reset it, try again, and find that it spits out only part of your beautiful graphic....

## No problem!

We'll take it from here. With our **JetRam™** line that supports the leading brands of laser printers and **PcRam™** line that upgrades your Notebook, Laptop or Desktop computers, Transcend can help solve your memory problems.

## What you get from our memory upgrades

- Life time warranty on all our products
- Full memory lines support a variety of brand names of laser printers and PCs
- High quality at a reasonable price
- Easy-to-install

Office hours: 6:00 a.m. to 6:00 p.m. Mon. to Fri.

**"You order in the morning, we will ship in the afternoon."**

See us at

**COMDEX/Fall '92**

Booth #S1094



\* All brand names are registered trademarks of their respective owners.

## Transcend

*Your Supplier, Your Partner,  
Your Friend.*

## Transcend Information Inc.

104 Exchange Place,  
Pomona, CA 91768 U.S.A.

TEL: (714) 598-5500

FAX: (714) 598-5050, (714) 598-6050

3Fl., No. 465, Chung Hsiao East Road,  
Sec. 6, Taipei, Taiwan, R.O.C.

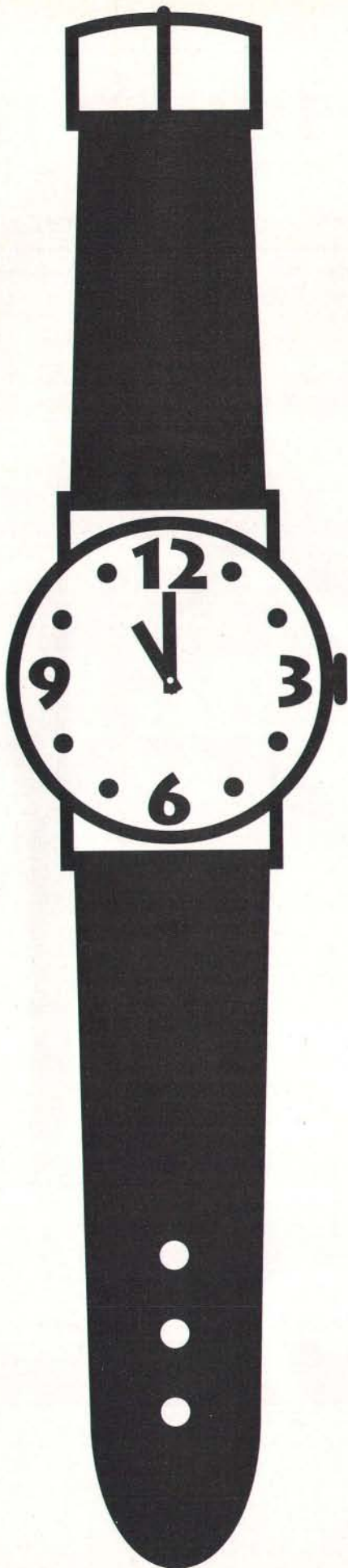
TEL: (886) 2-7881000

FAX: (886) 2-7881919, 7889191

Circle 261 on Inquiry Card (RESELLERS: 262).







# The Time Has Come...

...to send for the latest copy of the free Consumer Information Catalog.

It lists more than 200 free or low-cost government publications on topics such as money, food, jobs, children, cars, health, and federal benefits.

Don't waste another minute. Send today for the latest free Catalog and a free sample booklet. Send your name and address to:

**Consumer Information Center  
Department TH  
Pueblo, Colorado 81009**

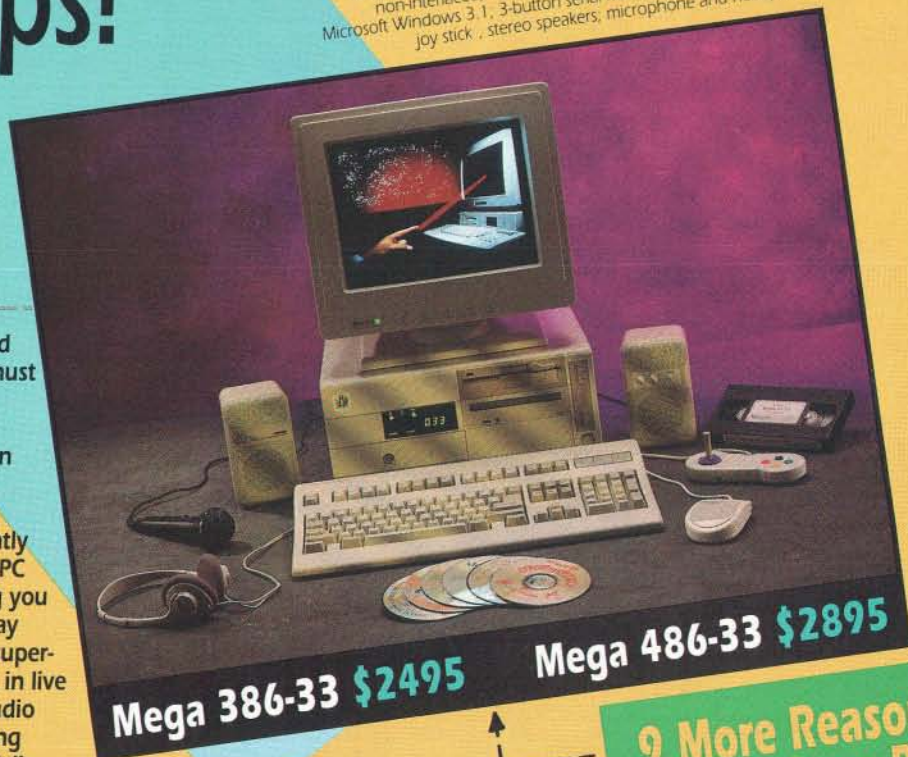


A public service of this publication and the Consumer Information Center of the U.S. General Services Administration



# Multimedia at your fingertips!

All systems arrive configured with 4MB expandable to 32MB on board, medium tower case (486-33) (mini-desktop case 386-33) with 230 watt power supply; TEAC 1.2 and 1.44MB floppy disk drives; Quantum 120MB, 17ms hard drive w/256K cache; AT/IO w/ 2 serial, 1 parallel and 1 game port; NEC internal CD-ROM drive, 280ms access time; 16 bit stereo 32 voice ultra sound card; 16 bit Hi-color VGA adapter w/1MB, 1024 x 768 Super VGA monitor, 28 dot pitch, non-interlaced; 101-enhanced keyboard; Microsoft DOS 5.0; Microsoft Windows 3.1, 3-button serial Microsoft compatible mouse; joy stick, stereo speakers, microphone and headphone.



**Mega 386-33 \$2495**

**Mega 486-33 \$2895**

## 9 More Reasons to Buy a Mega PC!

- ★ All Mega PCs display the MPC trademark, which preserves your investment in multimedia PC software and hardware.
- ★ All Mega PCs are fully tested and have a 48-hour dynamic burn-in to ensure quality performance.
- ★ All software are fully configured and pre-loaded on your hard disk, ready for you to plug and play.
- ★ Live video playback & Photo CD capable with the NEC Multispin CD-ROM, up to 300KB per second transfer rate.
- ★ We provide you with a LIFETIME of free labor for all repairs on equipment returned to us.
- ★ Super audio realism with UltraSound, supports 32 digital & synthesized voices for richer sound effects & music quality.
- ★ Lifetime toll-free tech support.
- ★ Dependability insured with our guaranteed warranty coverage that extends to 18 months on parts.
- ★ Every Mega PC has a 30 day money back guarantee.

These days, what dollars you spend on multimedia for work or home must be for quality hardware and software. Quality! That's exactly what's in your fingertip reach when you purchase our Mega PC.

Megamedia's products are stringently tested for compatibility with the MPC standards. We give you everything you need for a multimedia plug and play system. Our own quality PC; NEC super-multispin CD-ROM for the best in live animation; an UltraSound audio system that makes your Mega PC sing with 16 bit-44.1Hz sound and a 96db dynamic range for true CD quality audio.

Want more? You'll receive over \$1500 worth of popular CD-ROM titles as well! Plus, your investment is protected by our 30 day no questions asked money back guarantee if you are 100% satisfied with your Mega PC.

Call us by telephone and our Mega PC...both are just a fingertip away! Call us today and take advantage of these low prices!



- ★ **King's Quest V**-an epic battle of strength, wit and magic as you travel with King Graham
- ★ **Compton's Encyclopedia**-26 volumes on one CD-ROM disc; 13000 pictures and diagrams
- ★ **Guinness World Records**-features text of over 7000 world records; includes 300 color pictures.
- ★ **Chessmaster 3000**-definitely a left brain challenge; design and annotate your own games.
- ★ **Mixed-Up Mother Goose**-keep the kids occupied with this colorful, musical animated disc.
- ★ **Power Chords**-hot music composition and editing program. Create your own music quickly and easily.
- ★ **Mavis Teaches Typing**-award winning typing tutor. Enjoy audio voice-over throughout.
- ★ **Autodesk Multimedia Explorer**-Hours of fun creating your own cartoons and animations combine with music for a total MPC show!

...and more!

**MPC**  
Multimedia PC  
Megamedia systems are MPC approved ensuring multimedia software and hardware compatibility.



**1-800-Megamedia**  
**1-800-634-2633**

1701 D. Fortune Dr. San Jose, CA 95131  
Telephone (408) 428-9920 Fax (408) 428-9924

The MPC logo is a trademark of the Multimedia PC Marketing Council Inc. All other trademarks are those of their respective owners. Prices and specifications subject to change without notice. Not responsible for typographical errors.



Visa, MasterCard accepted at no additional charge. If you prepay by a cash instrument we will ship the system free of any freight charges by 2nd day air. Corporate and educational prices welcome with approved credit.

## SPECIAL BONUS!

Windows 3.1 Advanced Tutorial Video-Learn how to design your individual desktop, manipulate icons and tailor all aspects of Windows to suit your needs!

Call 263 on Inquiry Card.



# CYBERRESEARCH PC PRODUCTS FOR SCIENTISTS & ENGINEERS

## NEW Rack-Mount Computer Systems with Pull-out Keyboard & VGA Color Monitor

### Rack Mtg PC w/Pull-out Keyboard



#### Select a Complete System Configuration

Utilize components from our extensive product line and we will install and test them **at no extra charge** at our world headquarters in Branford, CT before shipping the complete system to you.

### High-Performance Rack-Mount PC's at Economical Desktop Prices!

Now you don't have to pay a huge premium to enjoy the benefits of a 19" rack-mountable PC.

#### Rugged Chassis Saves Rack Space

Many manufacturers would require you to use 10.5" of height for a PC, 14" for a monitor, and 3.5" for a keyboard drawer (on which you are supposed to balance the keyboard while you type.) This comes to 28" (16 rack units) of rack height. Our new VRK models include all of these components in just 10.5" (6 rack spaces) tall. You can fit 2 1/2 PC's in the space of their system, or simply have a rack-mount PC where it was never possible before.

VRK Rack-Mount PC's come in heavy-duty metal cases for EMI/RFI protection.

#### The VRK line includes the following features:

- Your choice of 80386 or '486 microprocessor. From affordable 386sx models to Ultimate-Performance 50MHz EISA-Bus Computers.
- 4MB of RAM (2MB on 386sx model).
- 10" VGA High-Resolution Color Monitor, with VGA Card included at no extra charge.
- Eight Expansion Slots.

- Industrial Keyboard pulls out and locks — does not move while typing. A protective door keeps keys safe from foreign materials when not in use.
- 1.2MB (5.25") or 1.44MB (3.5") Floppy Drive.
- 3 Full-access Drive Bays for Floppy Drives, etc.
- Hold-Down keeps Expansion Cards Firmly Seated.
- Floppy & IDE Hard Disk Controller Included.
- Dual-Fan Cooling System w/Honeycomb Filter.
- Rack-Mounting Slide Rails Included FREE.

**#VRK 386-20S** Rack-Mount 20MHz 80386sx PC w/VGA Monitor, Rack-Mount Keyboard, & 2MB RAM...\$395

**#VRK 386-33** Rack-Mount 33MHz 80386 PC w/VGA Monitor, Rack-Mount Keyboard, & 4MB RAM...\$395

**#VRK 486-33** Rack-Mount 33MHz 80486 PC w/VGA Monitor, Rack-Mount Keyboard, & 4MB RAM...\$4195

**#VRK 486-50** Rack-Mount 50MHz 80486 PC w/VGA Monitor, Rack-Mount Keyboard, & 4MB RAM...\$4495

**#VRK 486-50E** Rack-Mount 50MHz EISA-Bus 80486 PC w/VGA Monitor, R-M Keyboard, & 16MB RAM...\$5895

#### Prices subject to change (reduction) at any time

Also available as chassis-only for installation of computer by others. Call or FAX for the latest pricing, quantity discounts, and more information on the entire VRK rack-mounting product line.

**Circle 395 on Inquiry Card.**

## Keithley Metrabyte Sets the Standard — AGAIN

The DAS 16 analog converter board has always set the standard for PC-based data acquisition. Keithley Metrabyte has now set a new standard for price and performance. A total redesign using ASIC architecture has resulted in complete backwards compatibility, reductions of cost, size, and power consumption, and the addition of many new features, including:

- Programmable gains
- Demand-mode DMA
- Burst-mode timing
- 16 Analog inputs, 2 analog outputs, 32 digital I/O lines, 3 counter/timers
- BASIC drivers and pop-up control panel software included free.

**#DAS 1601** 100KHz, 16-Channel DAS Board w/Hi-Level Gains (1, 10, 100, 500)...\$895

**#DAS 1602** 100KHz, 16-Channel DAS Board w/Lo-Level Gains (1, 2, 4, 8)...\$895

**#DAS ASO** Advanced Software Option — Windows, C, Visual Basic Drivers...\$195

**Circle 397 on Inquiry Card.**



## Low-Cost Data Acquisition with the PCL 812

New A/D boards from Advantech have made data acquisition more affordable. Despite their low cost, these boards have not sacrificed performance or advanced capabilities. Our complete packages give you everything to set up your PC as a data acquisition station.

- 16 Single-Ended Analog Input Channels and 2 Analog Output Channels.
- Up to 30,000 Samples Per Second with 12-bit Resolution.
- 16 Digital Input Lines and 16 Digital Output Lines

**#PCL 812** 30KHz, 16-Channel, Low-Cost A/D Board w/ BASIC SW Drivers...\$395

**#PCL 812G** PCL 812 with Software-Programmable Gain Levels...\$495

**#PCL 812LT** Package of PCL 812, Labtech Notebook SW & Terminal Panel...\$1295

**#PCL 812GLT** Package of PCL 812G, Labtech Notebook SW & Terminal Panel...\$1395

**Circle 397 on Inquiry Card.**



Save with PCL812 Complete Packages!

## 19" Rack-Mount Keyboards just 1 Rack Unit High

If you use a standard keyboard with your rack-mount system, you know what a nuisance and a hazard it can be. These industrial keyboards are designed to fit easily into any EIA 19" rack. Rugged and reliable, these keyboards are made in the U.S.A. by a Swiss electronics company & demonstrate classic Swiss craftsmanship. Features Include:

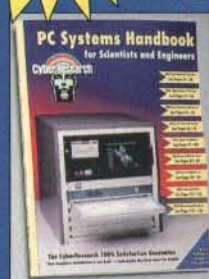
- 101-key layout & full-travel keys; unit pulls out & locks with a solid, tactile feel for comfortable touch-typing
- **#OIX 3010** drawer-mounted / **#OIX 6010** (shown) slides out with locking door
- Occupies only 1 rack space (1.75" high)
- **#OIX 3010** Low-cost, Drawer-Mounted Rack-Mount Keyboard (not shown)...\$295
- **#OIX 6010** Slide-out, Rack-Mount Keyboard w/locking drawer...\$395



OIX 6010

**Circle 395 on Inquiry Card.**

## FREE PC Systems Handbook for Scientists & Engineers



### This Combination Tutorial/Catalog Includes Many Examples of PC-based Systems

The CyberResearch *PC Systems Handbook for Scientists & Engineers* describes over 1400 unique and hard to find items for PC-based engineering. Packed with useful technical information and easy-to-read diagrams, this invaluable reference should be part of every engineer's library.

Fax, Call, or Write for a complimentary copy.

**Circle 396 on Inquiry Card.**

### The CyberResearch Advantage:

- ✓ **FREE Application Engineering**
- ✓ **Broadest Product Selection**
- ✓ **Everyday Low Prices**
- ✓ **100% Satisfaction Guarantee**

# CyberResearch

**Mailing Address:**  
P. O. Box 9565  
New Haven, CT 06535

**Worldwide**  
(203) 483-8815  
Fax: (203) 483-9024

## TOLL-FREE (800) 394-3300



### Notice to International Customers

You can buy direct from CyberResearch and **save 50% or more!** A majority of the leading brands of PC-based engineering products are available for export from CyberResearch at the same low prices as those enjoyed by our customers in the United States.

Due to contractual restrictions, products from some manufacturers are not available for export to certain countries.

Please fax a request for quotation listing brand and/or performance requirements, and we'll fax back a prompt response.

**Circle 396 on Inquiry Card.**



# BACKPACK IS TRANSPORTABLE.



Adding an easy-to-carry hard drive to your portable computer has never been easier! Backpack from Micro Solutions connects quickly to the parallel printer port of any PC compatible or portable – without interface cards or tools. Several computers can share



one Backpack, so you can back up your work or take it home to another computer. Diskette and tape drive models are also available. Backpack. Don't leave home without one. Call today for more information.

## backpack

**MicroSolutions**  
Computer Products

132 W. Lincoln Hwy., DeKalb, IL 60115 815-756-3411 Fax 815-756-2928



Circle 250 on Inquiry Card.





Serving you since 1979

# JDR Microdevices®

2233 Samaritan Drive, San Jose, CA 95124

BUY WITH CONFIDENCE FROM JDR!

- 30-DAY MONEY BACK GUARANTEE
- 1 YEAR WARRANTY
- TOLL-FREE TECH SUPPORT

**MMC**  
MICROCIRCUIT MANUFACTURING COMPANY

## UPRIGHT CASE

- Mounts 3 floppy and 4 hard drives
- Accommodates std. & mini motherboards
- 2 digit LED display

CASE-100A	.....	\$99.95
P5-250TW	250W p. supply	\$129.95
P5-300TW	300W p. supply	\$149.95
CASE-50	Mini 286-style case	\$59.95
CASE-70	Std. 286-style case	\$89.95
CASE-120	.....	\$199.95

Mini-upright case w/200W power supply

## POWER SUPPLIES

- U/L approved
- 110/220VAC, 50/60Hz

P5-150	8088 150 watt	.....	\$69.95
P5-200X	8088 200 watt	.....	\$89.95
P5-200	286/386/486 200 watt	.....	\$89.95
P5-250	286/386/486 250 watt	.....	\$129.95
P5-300	286/386/486 300 watt	.....	\$149.95

## 1024 X 768 NON-INTERLACED VGA PACKAGE

- 0.28mm dot pitch monitor & high-resolution VGA card
- 1024 x 768 in 16/256 colors  
640 x 480 in 16/256 colors  
320 x 200 in 16/256 colors
- 1Mb of video RAM

VGA-PKG-1024N	.....	\$499.95
VGA-PKG-1024+	1024x768 interlaced VGA pkg.	\$469.95
VGA-PKG	640x480 interlaced VGA pkg.	\$349.95
VGA-MON-1024	1024x768 interlaced monitor	\$349.95
VGA-MON-1024N	1024x768 non-interlaced mon.	\$389.95

## 2400 BAUD MODEM

- Internal data modem
- Hayes AT compatibility
- Config. as COM1-COM2

MCT-241 ..... \$49.95

## 9600 BAUD EXTERNAL MODEM

- CCITT V.42bis/V.32/V.22bis/Bell 212A & Hayes AT compatible
- Asynchronous / synchronous

VIVA-96E ..... \$299.95

## FAX/MODEM/PHONE SWITCH

- Save phone line charges! • Supports fax, modem, phone and answering machine from 1 phone line

FAXM-SWITCH	.....	\$119.95
FAX-SWITCH	Without modem connection	\$89.95

## BREADBOARD ON-A-CARD

- Solderless breadboard with I/O, decode & timing circuitry

PDS-601	8-bit card	.....	\$79.95
PDS-611	16-bit version	.....	\$89.95

## WIRE-WRAP PROTOTYPE CARDS

JDR-PR2	8-bit with I/O decode layout	.....	\$29.95
JDR-PR10	16-bit with I/O decode layout	.....	\$34.95

## PORTABLE IC TESTER

- Tests the following 14 to 20-pin devices: 74 series TTL, 40 & 45 series CMOS & 41/44 series DRAM up to 1Mb
- Identifies unknown part numbers

MOD-HIC ..... \$129.95

## MOTHERBOARDS

NEW  
LOWER  
PRICE!



## 25MHZ CACHE 486SX \$499.95

- 25MHz Intel 80486SX CPU • 64Kb cache memory on board (expandable to 256Kb) • Expandable to 32Mb on-board using 256Kb, 1Mb or 4Mb SIMMs (0Kb installed) • Includes Intel's "Vacancy" socket

MCT-M486SX-25	.....	\$499.95
MCT-M486-50	Mini-size 50MHz cache 486	\$1195.00
MCT-M486-33	Mini-size 33MHz cache 486	\$895.00
MCT-C386-40	Mini-size 40MHz cache 386	\$379.95
MCT-C386-33	Mini-size 33MHz cache 386	\$349.95
MCT-M386SX-25	Mini-size 25MHz 386SX	\$199.95
MCT-M286-16	Mini-size 16MHz 286	\$149.95
MCT-M286-12	Mini-size 12MHz 286	\$129.95
MCT-TURBO-10	Mini-size 10/4.77MHz 8088	\$69.95

## 16-BIT VGA CARD

- 8/16-bit 8088 and 286/386/486 compatible
- 640 x 480 in 16 colors  
320 x 200 in 256 colors
- 256Kb video RAM

MCT-VGA-1000	.....	\$49.95
SPEEDSTAR-24X	24-bit card, 1280x1024	\$199.95
STEALTH-VRAM	Windows accel., 1280x1024	\$249.95
MCT-VGA-4000	1024x768, 1Mb DRAM	\$129.95
MCT-FDC-HD	1.44Mb floppy controller	\$49.95
MCT-FDC-ED	2.88Mb intelligent floppy controller	\$79.95
MCT-IDEFH	16-bit IDE hard/floppy controller	\$29.95
MCT-IDEIO	16-bit IDE floppy/hard multi I/O	\$69.95
MCT-CIDEFH	16-bit IDE CACHE controller	\$299.95
MCT-IDE-8	8-bit IDE controller	\$99.95
MCT-AIO	Serial/parallel/game port card	\$49.95
MCT-AIO+	Two NS16550 serial/par/game port	\$89.95
DFINET-400	16-bit Ethernet card	\$139.95
GATEKEEPER	PC security card	\$49.95
PCODE	Diagnostic display card	\$49.95

## UNIVERSAL PROGRAMMER

- Programs EPROMs, EEPROMs, microprocessors, PROMs, PAL/GALs and other PLDs; tests logic & memory devices
- Adaptors available for PLCC, PGA, QFP & multiple DIP devices • Includes host adaptor card and cable

MOD-EMUP ..... \$699.00

## EPROM PROGRAMMER \$129.95

- Programs EPROMs to 27512, and up to 512K bit devices in up to 28-pin DIP packages
- Load file, Save file, Edit buffer, Blank check, Program, Read master and Verify modes

MOD-EPROM ..... \$129.95

## EPROM ERASER \$39.95

- Quickly and simultaneously erases up to 4 standard EPROMs

DATABASE II ..... \$39.95

## CONNER 84Mb DRIVE PACKAGE \$289

- CP-30084 84Mb, 19ms IDE hard drive, 16-bit floppy/hard disk controller, cables and instructions

HDKIT80 ..... \$289.00

## IDE HARD DRIVES

PART #	BRAND	CAP.	SPD.	TYPE	PRICE
CP-3000	Conner	42Mb	28ms	3.5" IDE	\$199
ST-351A	Seagate	42Mb	28ms	3.5" IDE	\$209
CP-30084	Conner	84Mb	19ms	3.5" IDE	\$269
ST-3096A	Seagate	88Mb	16ms	3.5" IDE	\$319
CP-30104	Conner	120Mb	19ms	3.5" IDE	\$329
ST-3144A	Seagate	131Mb	16ms	3.5" IDE	\$399
CP-3204F	Conner	212Mb	16ms	5.25" IDE	\$529

## FLOPPY DRIVES

FDD-1.44A	1.44Mb, 3.5", Beige	\$79.95
FDD-1.44X	1.44Mb, 3.5", Black	\$79.95
FDD-1.2	1.2Mb, 5.25", Beige	\$89.95
FDD-360	360Kb, 5.25", Black	\$89.95
FDD-2.88A	2.88Mb 3.5" drive, Beige	\$149.95
FD-505	5.25" & 3.5" combo drive	\$199.95

## DYNAMIC RAM

PART #	SIZE	SPEED	TYPE	PRICE
41256-80	256K x 1	80ns	DIP	1.69
41256-60	256K x 1	60ns	DIP	2.39
414256-80	256K x 4	80ns	DIP	5.45
1MB-80	1M x 1	80ns	DIP	4.99
1MB-60	1M x 1	60ns	DIP	5.49
41256A9B-80	256K x 9	80ns	SIMM	14.95
41256A9B-60	256K x 9	60ns	SIMM	16.95
421000A9B-10	1M x 9	100ns	SIMM	39.95
421000A9B-80	1M x 9	80ns	SIMM	45.95
421000A9B-60	1M x 9	60ns	SIMM	49.95
424000A9B-80	4M x 9	80ns	SIMM	149.95
424000A9B-60	4M x 9	60ns	SIMM	159.95

## MATH CO-PROCESSORS

intel

Each co-processor includes a manual, software guide and Intel's lifetime warranty.

PART #	SPEED	PRICE	PART #	SPEED	PRICE
8087-2	8MHz	129.95	80387-SXP	≤25MHz	79.95
8087	5MHz	89.95	80387-DXP	33MHz	89.95
80287-XL	12MHz	89.95	80487-SX	20MHz	499.95

## ENHANCED KEYBOARD \$49.95

BTC-5339 101/102-key enhanced layout ..... \$49.95

## 3-BUTTON MOUSE

- Accuracy 290 -1450 DPI
- Opto-mechanical design
- Windows 3.1 compatible

JDR-MOUSE-3 ..... \$14.95

MOUSE-PAD ..... \$4.95

## CALL FOR YOUR FREE JDR CATALOG TODAY!

FOR PC'S, SOFTWARE, MONITORS, DISK DRIVES, KEYBOARDS, MODEMS, CABLES, CONNECTORS, ICS, COMPONENTS, PROGRAMMERS, TEST EQUIPMENT, TOOLS & MORE!



NOW ORDER  
24 HOURS  
A DAY!

# 800-538-5000

Toll-free Fax ordering  
800-538-5005

Local 408-559-1200  
BBS 408-559-0253

KEY CODE 1034

TERMS: For shipping & handling include \$5.00 for ground & \$7.50 for air. Orders over 1 lb. and foreign orders may require additional shipping charges—contact our Sales Dept. for the amount. CA residents must include applicable sales tax. Prices subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sales. A full copy of our terms is available upon request. Items pictured may only be representative. JDR, the JDR logo, JDR Microdevices, and the MCT logo are registered trademarks of JDR Microdevices, Inc. Modular Circuit Technology is a trademark of JDR Microdevices, Inc. Copyright 1992 JDR MICRODEVICES.



# RIGHTON® COMPUTER SECURITY

AFFORDABLE • EFFECTIVE • MOBILE



SPOTLINK-5®

Righton® patented Spot® Anchors, with their special adhesive, are the best theft deterrents you can buy. Our versatile variety gives you options, easy access, and are easy to use. Spot-Link 5®, unlike competitors, is not dependent on the adhesive strength of a laminated top. Factory-direct prices from \$8.20 to \$32.50 save you money. Request our free brochure B with prices. Thank you.

5755 SW WILLOW LANE, LAKE OSWEGO OR 97035-5340  
(503) 636-6831 • FAX (503) 636-9642 Made in U.S.A.

SECURTECH CO.

Circle 252 on Inquiry Card.

## ZENTEK SYSTEMS

All Systems include 3.5" & 5.25" Floppy Drives,  
1024x768 SVGA Card w/512K, AMI BIOS  
Super IDE VIO Controller - 2HD/2FD/2S/1P/1G  
Desktop or Mini-Tower w/ 4 Drive Bays  
200W Power Supply & 101 Enhanced Keyboard  
**FREE MOUSE**  
**30 Day Money Back Guarantee**  
**1 year Parts & Labor warranty**  
**Free Technical Support.**

### 386SX-25 SVGA System \$950

- Intel or AMD 80386SX 25MHz CPU
- VLSI Chipset, Expandable to 16MB On-Board
- 2MB High Speed 70ns SIMM Memory Installed
- CTX 14" 1024x768 0.39mm SVGA Color Monitor
- 42MB 28ms IDE Hard Drive
- Seven 16-bit Expansion Slots
- 80387 Math Coprocessor Support
- Shadow RAM Support

### 386DX-40 SVGA System \$1,250

- AMD 80386DX 40MHz CPU
- Opti Chipset, Expandable to 32MB On-Board
- 4MB High Speed 70ns SIMM Memory Installed
- 64K Cache On-Board, Expandable to 256K
- CTX 14" 1024x768 0.28mm SVGA Color Monitor
- 100MB 15ms IDE Hard Drive
- Eight 16-bit Expansion Slots
- 80387 Math Coprocessor Support
- Shadow RAM Support

### 486DX-33 SVGA System \$1,599

- Intel 80486DX 33MHz CPU
- Opti Chipset, Expandable to 64MB On-Board
- 4MB High Speed 70ns SIMM Memory Installed
- 64K Cache On-Board, Expandable to 256K
- CTX 14" 1024x768 0.28mm SVGA Color Monitor
- 130MB 15ms IDE Hard Drive
- Eight 16-bit Expansion Slots
- Zero Wait State
- Shadow RAM Support

### 486DX-50 SVGA System \$1,999

- Intel 80486DX 50MHz CPU
- Opti Chipset, Expandable to 84MB On-Board
- 4MB High Speed 70ns SIMM Memory Installed
- 256K Cache On-Board
- CTX 14" 1024x768 0.28mm SVGA Color Monitor
- 210MB 15ms IDE Hard Drive
- Eight 16-bit Expansion Slots
- Zero Wait State
- Shadow RAM Support

Call For Other Configurations  
& Free Catalog

**ZENTEK**

The Deep Discount Computer People  
3670-12 W. Oceanside Road  
Oceanside, NY 11572

## NOTEBOOKS

Acer 386SX-20 w/ 1MB RAM & 40MB HDD	1250
Acer 386SX-20 w/ 1MB RAM & 80MB HDD	1449

## MOTHERBOARDS

386SX-25 Max. 16MB, AMI BIOS	149
386DX-40 w/54K, Max. 256K/32MB, AMI BIOS	229
486DX-33 w/54K, Max. 256K/64MB, AMI BIOS	549
486DX-50 w/256K Max. 256K/64MB, AMI BIOS	780

## FLOPPY DRIVES

Chincon 1.2MB 5.25" Floppy Drive	59
Chincon 1.44MB 3.5" Floppy Drive	59
Mitsumi 1.2MB 5.25" Floppy Drive	56
Mitsumi 1.44MB 3.5" Floppy Drive	56
Mounting Kit for 3.5" Drive	5

## HARD DRIVES

Seagate	
ST3511AX 42MB 28ms 3.5" IDE	189
ST3120A 100MB 15ms 3.5" IDE	289
ST1144A 100MB 15ms 3.5" IDE	339
ST1128A 210MB 15ms 3.5" IDE	549
ST1283A 245MB 12ms 3.5" IDE	639
ST1238A 330MB 10ms 3.5" IDE	1049
ST1480A 420MB 14ms 3.5" IDE	1149
ST1480E 603MB 15ms 3.5" ESDI	1289
Conner	
CP3000 42MB 28ms 3.5" IDE	189
CP3000A 60MB 19ms 3.5" IDE	219
CP3000B 80MB 19ms 3.5" IDE	269
CP3010A 120MB 19ms 3.5" IDE	335
CP3017A 170MB 17ms 3.5" IDE	349
CP3204 210MB 15ms 3.5" IDE	399
CP3504 500MB 12ms 3.5" IDE	1159

## I/O CONTROLLER CARDS

DTC 2290 IDE/EISA Controller Card	149
DTC 3280A ISA/SCSI Controller Card	149
DTC 3290A EISA/SCSI Controller Card	495
Adaptec 1522 SCSI Host Adapter Kit w/64K	169
Adaptec 1542B SCSI Host Adapter Kit w/128K	279
Super IDE VIO Controller (2S/1P/1G)	22

## TAPE BACKUP SYSTEMS

Colordex Jumbo D110-120MB	189
Colordex Jumbo D120-250MB	249
Colordex Tape Adapter Kit for External	40
Colordex External Kit for D1-10/DJ-20	99
Summit 120MB Tape Backup	195
Summit 250MB Tape Backup	255
3M DC1210 120/250MB Tape Cartridge	19

## CD-ROM

Chincon CDS-431 CD-ROM Internal	345
Chincon CDS-431 CD-ROM External	459
Compact Disk Cleaner	14
Laser Lens Cleaner	19
CD-ROM Drive Speaker SS-100 / CS-150	2935

## MONITORS

CTX	
14" SVGA 1024x768 0.39mm Color	229
14" SVGA 1024x768 0.28mm Color	289
14" SVGA 1024x768 0.28mm Color - NI	329
17" SVGA 1024x768 0.31mm Color - NI	779
17" SVGA 1024x768 0.28mm Color - NI	859
Maglantic	
14" Paper White Monochrome	109
14" SVGA 1024x768 0.28mm Color	279
14" SVGA 1024x768 0.28mm Color - NI	319
14" SVGA 1024x768 0.31mm Color - NI	759

Sekko	
14" SVGA 1024x768 0.25mm Color	459
14" SVGA 1024x768 0.25mm Color - NI	579

Samsung	
12" Amber Monochrome Monitor	79
14" Paper White Flat Screen Monochrome	119
14" VGA 800x600 0.41mm Color	229
14" SVGA 1024x768 0.28mm Color	269
14" SVGA 1024x768 0.28mm Color - NI	295
17" SVGA 1024x768 0.31mm Color - NI	799
17" SVGA 1280x1024 0.31mm Color - NI	879

## VIDEO BOARDS

Mono-Graphics Card w/ Printer Port	15
Realtek VGA Card 800x600 w/256K	33
Realtek SVGA Card 1024x768 w/512K/1MB	5373
Trident SVGA Card 1024x768 w/512K/1MB	6583
Cardinal 800x600 VGA Card w/256K	70
Cardinal 1024x768 Super VGA Card	
w/512K/1MB	99/128
Cardinal 1024x768 SVGA Card w/1MB	
and 32K/56K Colors	157/189

## WINDOW ACCELERATORS

Cardinal Windows Accelerator Card	225
Diamond Stealth VRAM w/1MB Hi-Color	259
Diamond StealthStar 24 w/1MB Hi-Color	175

## MODEMS & FAX

9600 Fax/2400 Internal Modem	95
2400 Modem Internal / External	49/65
9600 V.32 Modem Internal / External	239/249
QVC 9600 V.32 Modem Internal / External	269/299

## MICE

Artec Mouse Serial	15
Logitech Desco Serial Mouse	29
Logitech Desco Serial Mouse w/ Windows 3.1	75
Logitech TrackMan Serial / Bus	65/75
Logitech MouseMan Serial / Bus	65/69
Logitech MouseMan Serial w/ Windows 3.1	105
Logitech MouseMan Cordless	85
Logitech Katz Mouse	43

## SCANNERS

Logitech ScanMan Model 32	139
Logitech ScanMan Model 32 w/ OCR	175
Logitech ScanMan Model 256	259
Logitech ScanMan Model 256 w/ OCR	295
Chincon DS-3000 Color Scanner w/ OCR	745

## MATH COPROCESSOR

Cyrix 80387SX-16/20/25	89
Cyrix 80387DX-16/20/25/33/40	119

## SOUND CARDS

Sound Blaster	99
Sound Blaster Pro	185

## RAM CARDS

Accugolic RAMPAT	119
Accugolic RAMPATI Plus	149

## MEMORY

1MB x 9 SIMM 70ns	35
4MB x 9 SIMM 70ns	119

## LASER MASTER

Win Jet 800	895
Win Printer 800	1595

## PRINTERS

Star	
NX-1001	135
NX-1500	265
NX-2430	239

KXP-1100	149
KXP-1124	275
KXP-4410	629

## NETWORKING

LANtastic 2Mbps Starter Kit / Adapter	319/139
LANtastic Ethernet Starter Kit / Adapter	445/195
LANtastic Ethernet Starter Kit for Windows	405
LANtastic 10Base-T Starter Kit / Adapter	525/239
LANtastic 10Base-T Starter Kit for Windows	565

TERMS:  
• VISA, MC, C.O.D., Certified Check Accepted  
• No Surcharge on VISA/MC  
• Government, Corporate & School PO's Welcome  
• 30 Day Money Back Guarantee  
• Shipping within 24 hours  
• Free Tech Support  
• Pricing is subject to change without notice

## 5th ANNIVERSARY SPECIALS

### Floppy Diskettes Sale

3.5" DS/DD Bulk	\$0.35
3.5" DS/HD Bulk	0.34
5.25" DS/DD Bulk	0.20
5.25" DS/HD Bulk	0.30

### Pre-Formatted Diskettes

3.5" DS/DD Bulk	\$0.39
3.5" DS/HD Bulk	0.63

### Minimum Quantity 100

### Ribbons Special Sale

We have ribbons for most printers.  
Apple, Citizen, Epson, IBM, NEC,  
Star, Fujitsu, Okidata, Panasonic,  
Seiko, Plus Hundreds More...

### \$2.50 up

### Call for Complete Listing

SMC Active 8 Port Coax Arnet Hub	239
SMC Intelligent 8 Port Coax Arnet Hub	429
SMC Passive 4 Port Coax Arnet Hub	89
SMC 8-bit Arnet Card (Coax-Star)	72
SMC 8-bit Arnet Card (Coax-StarBus)	99
SMC 16-bit File Server Arnet Coax Card	209
SMC 16-bit Workstation Arnet Coax Card	129
SMC 14 Port 10Base-T Ethernet Concentrator	709
SMC 9-Port 10Base-T Ethernet Concentrator	329
SMC Elite Coax EtherCard 8 bit / 16 bit	119/149
SMC 16-bit 10Base-T Ethernet Card	189
D-Link Ethernet Card 16-bit	129
Zentek Active 8 Port Arnet Hub	145
Zentek Arnet Card 16 bit	79
Zentek Ethernet Card 16 bit	99

## BACKUP POWER SYSTEMS

American Power Conversion 400/250	179
American Power Conversion 450/300	229

## KEYBOARDS

Chicony 101 Keyboard	29
Mitsumi 101 Slot Kick Keyboard	30
Tangent 101 Keyboard	29

## ACCESSORIES

Power Center	15
6 Outlet Surge Suppressor Standard / Metal	7/8
2 to 1 / 4 to 1 Parallel Auto Switch	32/59
14" Non-glass Monitor Filter	20

## SOFTWARE

MS DOS 5.0	45
Windows 3.1	49

## CD-ROM SOFTWARE

Over 50 Different Titles

Call For Special Software Bundle Prices



# SAVE 50% TO 70%

## SATISFACTION GUARANTEED



## 386SX 40 Meg LAPTOP

800-635-0300

# 899.

### Famous Manufacturer

- 386SX 16
- 1 MB RAM Expandable to 2 or 5 MB
- 40 MB High Speed Hard Drive
- 1.44 3-1/2" Floppy Drive
- VGA Screen High Resolution Backlit 640 x 480 Grey Scales

- Removeable NiCad Battery, 2.5 hour
- 110/220 AC Adapter/Charger
- 81 Key Keyboard
- Serial, Parallel & External VGA Port
- 12" x 13" x 2.5"

100 Meg **CALL**

### OPTIONS:

- Carry Case
- 1 MB Memory
- 4 Meg

39.  
CALL  
CALL



### NEC 386SX 100 Meg

# 999.

Factory  
Renewed  
Factory  
Warranty

- 16 MHz 386SX
- 1 Meg RAM
- VGA Backlit Screen
- 100 Meg Hard Disk
- 3-1/2" 1.44 Meg Floppy
- Serial & Parallel Ports
- 110/220 Volt Charger
- External VGA Port
- Battery
- 15 lbs.
- 12.9" W x 3.4" H x 14.9" L

### OPTIONS:

- Carry Case 59.
- 2400 Baud Modem 99.
- 1 Meg Memory 99.
- 4 Meg Memory **CALL**
- Expansion Station **CALL**



### Famous Manufacturer 386SX/20 60 Meg Notebook

- 20 MHz 386SX
- 2 Meg RAM Expandable to 16 MB
- VGA Backlit Screen
- 60 Meg Hard Disk
- 3-1/2" 1.44 Meg Floppy
- Keyboard, Floppy AT Bus Port
- Serial & Parallel Ports
- 110/220 Volt Charger
- External VGA Port
- Battery
- 6.4 lbs.
- 11" W x 8.5" D x 2.0" H

### OPTIONS:

- Carry Case 29.
- Fax Modem 99.
- 2 Meg Memory 99.
- Expansion Station 299.

# 1099.

EVEN LESS

### NEC 386SX Color Laptop

- 16 MHz 80386SX
- 2 MB Memory
- 42 MB Hard Drive
- 3-1/2" 1.44 Floppy
- Display 64 Color Palette
- 640 x 400 EGA/CGA and VGA Mode Support

# 1599.

EVEN LESS

NEC Panasonic TI  
Sanyo Toshiba Bondwell  
More!

### Famous Manufacturers LAPTOPS/NOTEBOOKS!!

286/386SX/386SL  
CGA/EGA/VGA  
20/40/60/80 Meg Hard Drives  
Options: Case, Extra Memory  
Modems...



Starting at **799.**

### Portable Hard Drive

- 6" x 1-3/8" x 8-1/2"
- 2 lbs.
- 20 Meg
- Includes AC Charger & Battery
- Connects to any printer port
- Great for laptops & notebooks

Other sizes  
also available...  
**CALL**

# 279.

### Palm Top

- 128K
- 58 Keys
- 8 Lines, 40 Characters Screen

**Word Processor** - Compatible with Microsoft Word.

**Agenda** - Master Scheduler organizing with monthly, weekly & daily calendars.

**Data Base** - Holds names, addresses, phone numbers. Can call through acoustic coupler.

**Calculator** - Contains trig functions square and square roots.

**World** - Supplies current times & phone numbers for 400 cities worldwide.



# 299.

### 286 VGA 40 MEG DESKTOP SYSTEM



- 286 12 MHz
- 1 Meg RAM
- 1.44 Floppy
- 40 Meg Hard Drive
- VGA Card
- VGA Monitor .31 DP
- 1 Parallel, 1 Serial, 1 Mouse Port
- 101 Key Keyboard
- Battery Backed Clock
- Math Co-processor Socket

# 699.

CD ROM's

STARTING AT

# 299.

9 Years

Since 1983

# TrueData PRODUCTS, INC.

775 Quaker Highway, Rte. 146A, P.O. Box 347, Uxbridge, MA 01569

to order:

1-800-635-0300

In MA 508-278-6555

All packages shipped UPS and A.P.O.'s, C.O.D.'s add \$4.00. **ALL RETURNS** must have RMA# (call 508-278-6555). You may be subject to a restocking fee. Shipping/handling charges non-refundable. 1 year warranty unless otherwise noted. Prices/terms/conditions subject to change without notice. **Corporate P.O.'s welcomed. International orders also accepted.**

MC, VISA, Amex, Discover

All prices are cash discounted prices.

OCTOBER 1992 • B Y T E 319

86 & SX are trademarks of Intel Corporation

Circle 245 on Inquiry Card.



# MEMORY AND MORE...

## Personal Computer Memory

### IBM

PS/1 286, 386SX	
2MB	92F9935 ..... \$99
PS/2 30/286, Expansion board 1697259	
2MB Kit	50F5360 ..... \$99
PS/2 35SX; LS, 40SX, 50SX, 55SX; LS, 65SX; LS, 70	
4MB 6450603 ..... \$51	2MB 6450604 ..... \$89
PS/2 70-A21; A21; A21; B21	
2MB	6450608 ..... \$95
PS/2 35SX; LS, 40SX, 55SX; LS, 65SX; LS, 70	
4MB 34F2933 or 67F9977 ..... \$169	
PS/2 35SX; LS, 40SX	
4MB	6450129 ..... \$349
PS/2 90, 95, AMD P75 (install in pairs)	
4MB 6450128 ..... \$169	4MB 6450150 ..... \$349
Expansion boards for 50, 502, 55SX, 60, 65SX	
2-8MB with 2M	1497259 ..... \$269
2-16MB with 2M	6450609 ..... \$319
Expansion boards for all models 70 and 80	
2-14MB with 2M	34F5077 ..... \$329

### Compaq

ProLinea 3/25; Z5	
2MB 141750-001 ..... \$90	4MB 141742-001 ..... \$285
DeskPro 386-20, 20E and Z5	
4MB Module	115152-001 ..... \$179
4MB Board	115645-001 ..... \$249
DeskPro 386S/16	
4MB Module	112534-001 ..... \$179
4MB Board	115634-001 ..... \$259
DeskPro 286II, 386II, 386SX/20, 386/25M, 486/33M, 486S/25M,	
486S/16M; SystemPro LT, 486SX/25S; 586/25S; Portable 486C	
1MB 118680-001 ..... \$59	2MB 118680-001 ..... \$99
4MB 118690-001 ..... \$169	4MB 112877-001 ..... \$399
DeskPro 386-33, 486-33, and SystemPro	
2MB 115144-001 ..... \$119	4MB 116561-001 ..... \$329
DeskPro 386M, 486M, SystemPro LT (52-Bit Exp. board)	
2-64MB w/2M	129160-001 ..... \$579

### Zenith

Zenith Z-386/20; 25; 33 and 35E	
1MB ZAS800ME ..... \$59	4MB ZAS800MK ..... \$179
Zenith Z-386SX, 286PL+, Z-15	
2MB Kit	Z-605-1 ..... \$99

### Hewlett-Packard

Vectra 65/16S; 20PC, RS/20PC; 25PC, 20C	
4MB Kit	D1542 or 1642A ..... \$179
Vectra 386/16M, 386/20M	
2MB D2406A ..... \$109	4MB D2404A ..... \$329
Vectra 486 PC (install in pairs)	
8MB D2152A ..... \$559	4MB D2151A ..... \$179
Vectra 386/25, 486/25T, 33T (install in pairs)	
2MB	D2381A ..... \$99

### NEC

Powermate 286/12; SX/16 and SX/20	
2MB Kit	OP-410-8103 ..... \$99
Powermate 386/20; 25	
2MB APC-H655 ..... \$359	4MB APC-H656 ..... \$899
Powermate 386/33E and 486/25E	
2MB	OP-410-5101 ..... \$219

### AST

Bravo 386-SX, WS/286, 386	
2MB 500510-002 ..... \$89	4MB 500510-008 ..... \$179
Premium 386/25; 33; 33T, Premium II 386SX/16; 20	
1MB w/WPB	500780-005; 002 ..... \$69
Bravo 4/33; 486/25; Premium II; TE; Server SE 4/33	
2MB w/WPB	500718-004; 780-005 ..... \$129
Premium II (All), Premium 386/33T and 386SX/16	
4MB w/WPB	500780-004 ..... \$169
All Premium 386/33T, 486/33T, Server SE 4/33, Bravo 486	
8MB w/WPB	500780-001 ..... \$339

Please call for any upgrade not listed.

## Kingston TECHNOLOGY CORPORATION

### Turn your 286 into a 386 with the SX/Now!

True multitasking, background operation for Windows 3.1, OS/2, and 386 software. SX/Now! Includes a Math coprocessor socket, 8Kb cache and improves system performance by up to 350%.

#### The SX/Now! is now available for:

- ✓ HP ES286/12 & ES/8
- ✓ Epson Equity IIe & Epson Equity IIPlus
- ✓ IBM Original AT and XT/286
- ✓ AGI 1800A, B, C
- ✓ AST Premium 286 and Bravo 286
- ✓ Compaq Portable III and DeskPro 286
- ✓ NEC PowerMate 286+ and Portable+
- ✓ IBM PS/2 25/286, 30286, 50, 502, 60

"Kingston Technology Corp.'s SX/Now! is the undisputed performance champ."

-PC Magazine, Oct 29, 1991

20MHz SX/Now! ..... \$309

25MHz SX/Now! ..... \$359

## Mhz Megahertz CORPORATION

### Laptop and Notebook Modems

#### Internal, External, Send & Receive FAX

##### For use in these models:

- Compaq Contura, LTE 386S/20, Lite, Portable 486C
  - Toshiba T1000SX/KE/LE, T1200; KE, T1600, T2000SX; SX, T3100; T3100e; T3100SX, T3200SX, T5100 and T5200
  - Zenith Z-Note, Super; Master; Mini; SlimsPort
  - AST Premium Executive Notebook
  - Sharp 6220, 6641
  - TI TravelMate 2000, 3000
- All Megahertz modems include:
- Easy installation with illustrated user's guide
  - Full 5-year warranty
  - Hayes-compatible
- 2400bps w/V.42bis MNP-5 ..... \$179
- 24/9600bps w/V.42bis MNP-5 Send/Rec Fax ..... \$319
- 96/9600bps w/V.42bis MNP-5 Send/Rec Fax ..... \$629
- Universal Pocket Modems for any RS232C serial port
- 24/9600bps w/V.42bis MNP-5 Send/Rec Fax ..... \$279

## BOCA RESEARCH INC.

### Expansion Boards

BocaRam XT 512K-2MB for XT and PS/2 25 and 30 machines.

Provides LHM 4.0 expanded memory only.

w/312K ..... \$129 w/1.5MB ..... \$195

w/1MB ..... \$162 w/2MB ..... \$229

BocaRam AT Plus 2-8MB memory board for 80286 & 80386

IBM compatible machines running up to 33MHz. Get conventional, expanded (LHM EMS 4.0) and/or extended memory.

supports OS/2.

w/2MB ..... \$189 w/6MB ..... \$299

w/4MB ..... \$249 w/8MB ..... \$379

BocaRam AT I/O Plus 2-4MB memory board, same as AT Plus

with 1 serial and 1 parallel port. Uses 1MB x 1 DRAM chips.

w/2MB ..... \$199 w/4MB ..... \$279

### Video Cards

#### Boca Research

Basic VGA 640x480 16 color ..... \$69

Super VGA 1024x768 16 color ..... \$119

Super X VGA 1024x768 256 color ..... \$159

### Diamond Computer

Stealth V-RAM High-Color SVGA 1MB ..... \$265

SpeedSTAR 24 True Color Card ..... \$199

## Laptop & Notebook Memory

### AST

Premium Exec Notebook	1MB ..... \$69
4MB	..... \$169

### Compaq

Contura 3/20 and 3/25	4MB ..... \$199
4MB	..... \$129
LTE 286 Notebook	4MB ..... \$199
4MB	..... \$99
LTE 386S/20 Notebook	4MB ..... \$249
4MB	..... \$199
LTE Lite 20; 25 Notebook	4MB ..... \$289
4MB	..... \$89
SLT 386 Notebook	4MB ..... \$249

### Dell

NL20 and NL25 Notebook	2MB ..... \$159
212M and 320M Laptop	1MB ..... \$109
2MB	..... \$159

### Everex

Tempo LX Notebook	2MB ..... \$109
Tempo Carrier Notebook	2MB ..... \$179

### IBM

CL75SX Color Notebook	4MB ..... \$349
4MB	..... \$669
NS1 Notebook (All)	2MB ..... \$179
4MB	..... \$249
LA05X and N35SX Notebook	4MB ..... \$159
LA05X	8MB ..... \$339

### NEC

UltraLite III, SL/25C	2MB ..... \$199
4MB	..... \$449
UltraLite SL/20, SL/20P	2MB ..... \$219
6MB	..... \$659
ProSpeed 286, 386SX-16	1MB ..... \$119
4MB	..... \$339
ProSpeed 386	2MB ..... \$159
8MB	..... \$699

### Texas Instruments

TravelMate 2000	1MB ..... \$119
TravelMate 3000, WinSX	2MB ..... \$99

### Toshiba

T1000SE; LE; KE, 2000SX; SXe, 2200SX	2MB ..... \$119
4MB	..... \$219
8MB	..... \$399
T1200XE, 1600, and 3100E	2MB ..... \$99
T3100SX, 3200SX, and SXC Portables	2MB ..... \$99
4MB	..... \$169
T3200	3MB ..... \$159
T3300SL Notebook	2MB ..... \$179
4MB	..... \$329
T4400 and T6400, SX, SXC Notebook	2MB ..... \$209
4MB	..... \$309
8MB	..... \$649
T5100	2MB ..... \$109
T5200; T5200C and T8500	2MB ..... \$109
4MB	..... \$359

### Zenith

Z-Note Notebook	2MB ..... \$169
8MB	..... \$559
2MB	..... \$129
MastersPort 386SL, SL/C, SL/e	2MB ..... \$159
MastersPort 386SX	2MB ..... \$159
SupersPort SX; 286C; SlimsPort	1MB ..... \$109
SupersPort 286; 286C	4MB ..... \$299
TurboPort 386; 386C	1MB ..... \$89

### Other Upgrades

Grid 1450SX	2MB ..... \$189
Grid 1500 Series	4MB ..... \$259
Panasonic CF170, CF270, CF570	1MB ..... \$69
Sanyo and Zens Notebook Memory	2MB ..... \$109
Magnavox 286 and 386SX Notebook	1MB ..... \$109
4MB	..... \$269
Packard Bell 286 and 386SX Notebook	1MB ..... \$109
4MB	..... \$269
Sharp 6220 Notebook	1MB ..... \$119

## Laser Printer Memory

Hewlett-Packard LaserJet IIP, III, IIP, IID	
2MB 33475B ..... \$115	4MB 33477B ..... \$179
Hewlett-Packard LaserJet II and IID	
2MB 33444B ..... \$115	4MB 33445B ..... \$179
Hewlett-Packard LaserJet IIISI	
1MB C2065A ..... \$59	4MB C2065A ..... \$159
Hewlett-Packard DeskJet 500, 500C	
256K	22707B ..... \$69
IBM Laser 4029 All Models	
2MB 118333A ..... \$129	4MB 118333S ..... \$189
Canon LBP-4	
1MB 563-2230 ..... \$169	2MB PN N/A ..... \$229
Canon LBP-III and BIII Plus	
2MB 563-2350 ..... \$249	3MB 563-2360 ..... \$299

Brother HL-8, BE, BD, BV	
1MB MB-810 ..... \$149	2MB MB-820 ..... \$199
Panasonic 4410 and 4430	
2MB KX-P441 ..... \$129	4MB PN N/A ..... \$209
Panasonic 4450I and 4420	
2MB KX-P441 ..... \$129	4MB PN N/A ..... \$209
Okilaser 400	
1MB 70014701 ..... \$99	2MB OKI PN N/A ..... \$129
Texas Instruments MicroLaser and XL	
1MB	2555739-0001 ..... \$59
Epson EPL 6000	
2MB 183401 ..... \$119	4MB PN N/A ..... \$189
Epson ActionLaser II, EPL-8000	
2MB PN N/A ..... \$169	4MB PN N/A ..... \$259

**TOLL FREE 800-535-5892**

Circle 238 on Inquiry Card (RESELLERS: 239).

**COMPATIBILITY**  
**100%**  
**GUARANTEED**

OR YOUR MONEY BACK!

## FIRST SOURCE WILL GIVE YOU GREAT QUALITY PRICE, SERVICE AND SUPPORT.

- ◆ 30 Day Money Back Guarantee!
- ◆ Installation instructions include with all products
- ◆ Toll-free technical support
- ◆ All products are user installable
- ◆ Manufacturer's warranties
- ◆ Thousands of products in stock
- ◆ APO/FPO, and International orders welcome
- ◆ Purchase orders accepted from Universities, Qualified Firms, and Government Agencies.

## SPECIAL PRICING ON VOLUME ORDERS DELIVERY GUARANTEED



- ◆ Fast, inexpensive, dependable delivery to any worldwide destination with Federal Express
- ◆ Same day shipping
- ◆ Overnight delivery available
- ◆ You are never charged a surcharge on your credit card



**TOLL FREE FROM THE US OR CANADA**

**800/535-5892**

**INTERNATIONAL**

**714/588-9866**

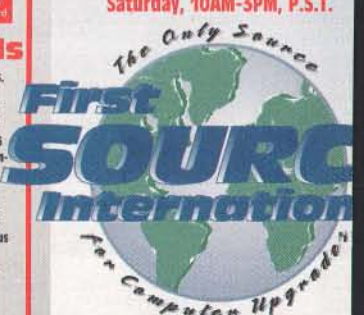
**FAX LINE**

**714/588-9872**

**BUSINESS HOURS**

**Monday-Friday, 8AM-5PM**

**Saturday, 10AM-3PM, P.S.T.**

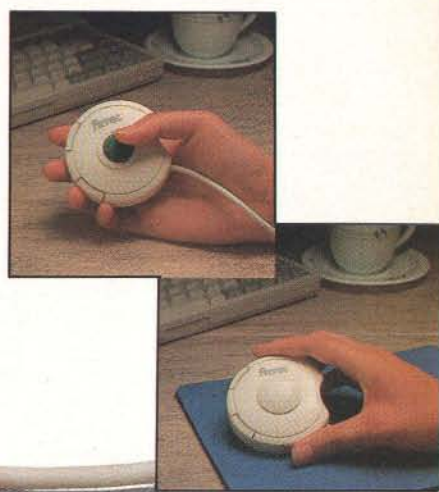


**First Source International**  
36 Argonaut, Suite 140  
Aliso Viejo, CA 92656-1432

Terms/Conditions: Memory products are third party, manufacturers' part and are for your convenience. Freight charges are non-refundable. A 30% restock will be charged on all non-defective returns, unopened, and unused. Items must be returned within 15 days with original documentation. A Returned Merchandise Authorization number is required. Availability is subject to change without notice. Purchase prices at the time of order are final. First Source International cannot be responsible for errors in type or photography. We will not accept advertising prices valid only on identical brand not good for SIMMs or DRAM. Trademarks and registered trademarks are respective companies.



# TWO FUNCTIONS IN ONE MOUSE



ULTIMA ELECTRONICS CORP.

**MAIN OFFICE**  
9F, NO. 18, ALLEY 1, LANE 768, SEC. 4, PA TE ROAD,  
TAIPEI, TAIWAN, R.O.C. TEL: 886-2-7885470 (REP.)  
FAX: 886-2-7885657, 7885655  
**USA BRANCH**  
3358 GATEWAY BLVD FREMONT CA94358 U.S.A.  
TEL: 510-4401200 FAX: 510-4401216

**HONG KONG BRANCH**  
WORKSHOP NO. 24 ON 10/F PACIFIC TRADE  
CENTRE 2 KAI HING ROAD KOWLOON BAY,  
KOWLOON HONG KONG  
TEL: 852-7578059, 7578072  
FAX: 852-7537795  
**HUNGARY**  
HUMANSOFT ELECTRONICS LTD.  
TEL: 361-1833930 FAX: 361-18311789

**GERMANY**  
ELITO ELECTRONIC GMBH  
TEL: 09241/5065 FAX: 09241/1508  
R+P SUPERWAVE ELECTRONIC GMBH M.  
TEL: 030-788-040 FAX: 030-786-4147  
TLX: 16419 BURYA  
R+P COMPUTER GMBH QUERSTUCKEN  
TEL: 040-524-50-38 FAX: 040-524-29-01

**DENMARK**  
UNIPRO A/S TEL: 4586286366 FAX: 4586286870  
**HOLLAND**  
SOECOMA COMPUTERS BV TEL: 31-40-533515 FAX: 31-40-544535  
**ITALY**  
COVER s.r.l. TEL: 0444/491000 FAX: 0444/491010  
**CZECHOSLOVAK**  
SESO spol.s.r.o. Tel: 02/7812514 Fax: 02/7822285

Circle 246 on Inquiry Card (RESELLERS: 247).

## AMT INTERNATIONAL (COMPUTERS & PERIPHERALS)

3074 LANDESS AVENUE · SAN JOSE, CA 95132  
TEL: (408) 942-9695 · FAX: (408) 942-5509



**LOWEST PRICES  
SAME DAY SHIPPING**

### COMPAQ MEMORY

DeskPro 286-E, 386-20/20E/25	
1MB 11131-001	\$75.00
4MB 11132-001	\$169.00
DeskPro 286N, 386N and 386SX	
2MB 11868-001	\$135.00
4MB 11869-001	\$230.00
DeskPro 386S	
1MB 11364-001	\$99.00
4MB 11253-001	\$195.00
DeskPro 386-33, 486-33 & SystemPro	
2MB 11514-001	\$185.00

### AST MEMORY

Bravo-286, Workstation	
512K Kit 500510-010	\$59.00
2MB Kit 500510-002	\$150.00
Premium 386-16/20C	
1MB Kit 500510-003	\$75.00
4MB Kit 500510-004	\$185.00
Premium 386-20	
1MB Kit 500510-003	\$75.00
4MB Kit 500510-004	\$185.00
Bravo-386SX	
4MB Kit 500510-008	\$220.00
Premium 386-SX/25/33 & 486-25	
1MB 500718-002	\$60.00
4MB 500-780	\$195.00

### HEWLETT-PACKARD MEMORY

Vectra GS/16S	
1MB	\$65.00
4MB	\$185.00
Vectra GS/20PC, RS/25PC and 20C	
1MB D1640A	\$65.00
4MB D1642A	\$170.00
Vectra 486PC	
1MB D2150A	\$75.00
4MB D2151A	\$165.00

### IBM PS/2 MEMORY

Models 30-286, Exp. Board 1497259	
512K Kit 30F5348	\$54.00
2MB Kit 30F5360	\$95.00

### Models 70-E61/121, 55SX, 65SX

1MB 6450603	\$59.00
Models 70-E61/121, 50Z, 55SX, 65SX	
2MB 6450604	\$99.00
Models 65SX, 65SX, 34F3077 & 34F3011	
4MB 34F2933	\$149.00

### Models 70-A21

2MB 6450608	\$99.00
-------------	---------

### Models 80-141

1MB 6450375	\$75.00
-------------	---------

### Models 80-111/311

2MB 6450379	\$99.00
-------------	---------

### All Models 70 and 80

2-14MB w/2M 34F3077	\$290.00
4-16MB w/4M34F3011	\$350.00

### Models 50, 50Z, 55SX & 60

2-8MB 1497259	\$290.00
---------------	----------

### LASER PRINTER MEMORY

#### Hewlett-Packard Laser Jet IIP, III & IID

1MB 334748	\$70.00
2MB 334758	\$99.00
4MB 334778	\$185.00

#### Hewlett-Packard Laser Jet IIP & IID

1MB 334438	\$75.00
2MB 334448	\$110.00
4MB 334458	\$175.00

#### IBM Laser 4019 and 4019e

1MB 1039137	\$95.00
3.5MB 1038675	\$195.00
Canon LBP-811, 811R, 811T	
2MB S63-1880	\$129.00

### LAPTOP AND PORTABLE MEMORY

#### TOSHIBA MEMORY

1MB Model 1000SE/XE	\$110.00
2MB Model 1000SE/XE	\$99.00
2MB Model T1200XE	\$99.00
2MB Model T1800	\$99.00
2MB Model T3100E	\$99.00
2MB Model T3100SX	\$99.00
4MB Model T3100SX	\$195.00
4MB Model T3200SX	\$195.00
4MB Model T3200SX	\$195.00
2MB Model 5100	\$99.00
2MB Model T5200, T8500	\$110.00
8MB Model T5200, T8500	\$299.00

### ZENITH MEMORY

1MB SuperSport 286 & 286ES	\$135.00
2MB SuperSport 286 & 286ES	\$140.00
2MB SuperSport SX/Alpha	\$140.00
2MB SuperSport SX/Beta	\$140.00

### COMPAQ MEMORY

1MB Portable LTE 286	\$125.00
2MB Portable LTE 286	\$150.00
1MB SLT-286	\$140.00
4MB SLT-286	\$350.00

### NEC MEMORY

1MB Prospeed 286	\$170.00
2MB Prospeed 386	\$240.00

### ZENITH MEMORY

Zenith Z-386/20/25/33 & 33e	
1MB ZA38/3800ME	\$90.00
2MB ZA3800MG	\$140.00
4MB ZA3800MK	\$205.00

#### Zenith Z-386 SX

2MB Z-605-1	\$125.00
-------------	----------

### MATH COPROCESSORS

INTEL	
8087-5 MHz	\$50.00
8087-2 8MHz	\$60.00
8087-1 10MHz	\$105.00
8087-6 6MHz	\$50.00
8087-8 8MHz	\$59.00
8087XL 8/10MHz	\$69.00
8087XL & XLT	\$69.00
8087-10 10MHz	\$59.00
80C287-12 12MHz	\$69.00
8087SX-16	\$85.00
8087SX-20	\$85.00
8087DX-20	\$89.00
8087DX-25	\$89.00
8087DX-33	\$89.00
80487SX-20	\$435.00
WEITEK	
3167-20 20MHz	\$80.00
3167-25 25MHz	\$135.00
3167-33 33MHz	\$240.00
4167-25MHz	\$325.00
4167-33MHz	\$595.00
CYRIX	
82S87XL	\$59.00
83D87-16	\$59.00

83D87-20	\$85.00
83D87-25	\$85.00
83D87-33	\$85.00
83D87-40	\$99.00
83S87-16	\$75.00
83S87-20	\$75.00
83S87-25	\$75.00

### IT

2C87-8	\$49.00
2C87-10	\$59.00
2C87-12	\$59.00
2C87-20	\$69.00
3C87-20	\$79.00
3C87-25	\$79.00
3C87-33	\$79.00
3C87-40	\$95.00

### 387-16

3587-20	\$69.00
3587-25	\$69.00
3587-33	\$69.00

### AMD

80C287-10	\$35.00
80C287-12	\$69.00

### SIMM MODULES

#### IBM TYPE

ADD \$2.00 FOR SIPPIS

4Mx9-80	\$105.00
4Mx9-70	\$107.00
1Mx9-60	\$35.00
1Mx9-10	\$30.00
1Mx9-80	\$35.00
1Mx9-70	\$36.00
256x9-70	\$10.00
256x9-10	\$9.00
256x9-80	\$10.00
256x9-60	\$12.00

#### APPLE-MAC

1Mx8-70	\$32.00
1Mx8-10	\$27.00
1Mx8-80	\$30.00
4Mx8-80	\$95.00

### DRAM

#### DRAM IMGX1

1 MGX1-120NS	\$3.00
1 MGX1-100NX	\$3.50
1 MGX1-80NX	\$3.60
1 MGX1-70NX	\$3.65
1 MGX1-60NX	\$3.75

### DRAM 64X1

4164-150	\$0.85
4164-120	\$0.95
4164-100	\$1.50
4164-80	\$2.00

### DRAM 64X4

4464-15	\$1.50
4464-12	\$1.99
4464-10	\$2.50

### DRAM 256X1

256X1-150NS	\$0.85
256X1-120NS	\$0.89
256X1-100NS	\$0.99
256X1-80NS	\$1.10
256X1-70NS	\$1.20
566X1-60NS	\$1.25

### DRAM 256X4

256X4-100NS	\$2.95
256X4-80NS	\$3.00
256X4-70/60NS	\$3.50

### 256X1-STATIC COL

51258P-10	\$0.99
AAA 2800-08	\$1.29
AAA 2800-07	\$1.35
AAA 2800-60	\$1.55
1X4-80 ZIPP	\$14.00
1X4-80STT ZIPP	\$16.00
1X4-70STT ZIPP	\$17.00

### SYSTEM

#### 486-33 w/ 64k cache

• 4MB RAM • 1.2 & 1.44 • 130 HD	
• VGA • SVGA 28 Monitor • 101 KB	
• Mini-Tower Case • DCS 5.0	

\$1529.00

### MONITORS

#### VGA 41 14"

SVGA 28 14"	\$215.00
SVGA 28 14" Non-Int	\$260.00
SVGA 25 14" Non-Int	\$310.00
SVGA 28 17"	\$510.00
SVGA 28 17"	\$775.00

### MOTHER BOARDS OK

#### 486-33 w/ 256k cache

486-33 w/ 64k cache	\$595.00
486SX-20/25	\$239/269.00

### FLOPPY DRIVES

#### 2400bps Internal

2400bps Internal	\$45.00
9600bps Internal	\$299.00

### FAX/MODEM

#### 9600bps IntS/R Fax

9600bps IntS/R Fax	\$79.00
2400bps Modem	\$99.00

### 386-33 w/ 64k cache

386-25 Non-cache	\$220.00
386SX-16/25	\$105/135.00

### MEMORY BOARDS OK

Boca AT+	\$115.00
Boca XT or 30	\$115.00
Orchid 16/32	\$269.00
Orchid 8/16	\$159.00
Ramport	\$95.00
Simply Ram	\$189.00
TI Ram PS/2	\$199.00

### 1X4 4X1 STATIC

514402-80 (1x4) STT, ZIPP	\$14
514400-80 (1x4) ZIPP	15
514400-80 (1x4) DIPP	14
514400-80 (1x4) SOJ	11
514100-80 (4x1) SOJ	11

### CASES

Mini-Tower	\$70.00
Mid-Tower	\$89.00
Full-Tower	\$119.00
Desktop	\$95.00

### HARD DRIVES

44MB, 28ms, IDE	\$185.00
89MB, 14ms, IDE	\$250.00
130MB, 15ms, IDE	\$319.00
210MB, 15ms, IDE	\$475.00

### MODEMS

2400bps Internal	\$45.00
9600bps Internal	\$299.00

### FAX/MODEM

9600bps IntS/R Fax	\$79.00
2400bps Modem	\$99.00



# The Ultimate Power Platforms.

## For 486 Windows and CAD - Comtrade's EISA or Local Bus.

### 486 EISA Win-Station

- 64K Super Fast Write-Back Cache SRAM
- 4MB RAM & Built-in 487 Math Coprocessor
- 1.2MB 5.25" & 1.44MB 3.5" Floppy Drives
- 32-Bit EISA Hard Disk Controller (350% faster DTR)
- 130 MB 15ms IDE Drive with 64K Cache
- Diamond Stealth S3 Graphics Accelerator w/ 1MB VRAM (Up to 25 times faster than standard super VGA)
- 14" Non-Interlaced .28mm SVGA Color Monitor
- 2 Serial, 1 Parallel, & 1 Game Ports
- Enhanced 101-Key Keyboard
- Hi-Resolution 400DPI Serial Mouse
- Microsoft DOS 5.0 & Windows 3.1

486/33 DX \$2145  
486/50 DX2 \$2325  
486/50 DX \$2445  
486/66 DX2 \$2645

- 8MB RAM & 210MB Drive Upgrade Add \$320
- 15" MAG Flat Screen 1280x1024 Monitor Add \$290

### Local Bus Win-Station

- 64K Super Fast Write-Back Cache SRAM
- 4MB RAM & Built-in 487 Math Coprocessor
- 1.2MB 5.25" & 1.44MB 3.5" Floppy Drives
- 130MB 15ms IDE Drive with 64K Cache
- 32-Bit Local Bus Viper S3 Graphics Accelerator with 1MB VRAM (Up to 1280x1024 & up to 32K Colors) (Up to 50 times faster than standard super VGA)
- 14" Non-Interlaced .28mm SVGA Color Monitor (VESA Standard for 72Hz Flicker-Free Display)
- 2 Serial, 1 Parallel, & 1 Game Ports
- Enhanced 101-Key Keyboard
- Hi-Resolution 400DPI Serial Mouse
- Microsoft DOS 5.0 & Windows 3.1

486/33 DX \$1875  
486/50 DX2 \$2075

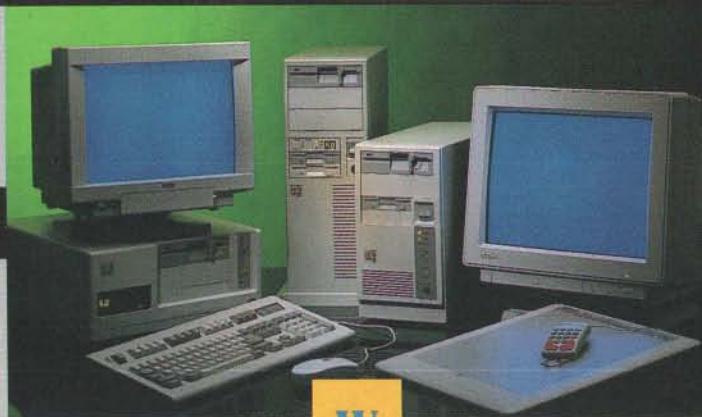
- 8MB RAM & 210MB Drive Add \$320
- 32-Bit Local Bus Hard Disk Controller Add \$60

### Local Bus CAD-Station

- 64K Super Fast Write-Back Cache SRAM
- 8MB RAM & Built-in 487 Math Coprocessor
- 1.2MB 5.25" & 1.44MB 3.5" Floppy Drives
- 210MB 15ms IDE Drive with 64K Cache
- 32-Bit Local Bus Viper S3 Graphics Accelerator with 1MB VRAM (Up to 1280x1024 & up to 32K Colors) (Up to 50 times faster than standard super VGA)
- AutoCAD Display List Driver
- 17" Flat Screen 1280x1024 SVGA Monitor
- 2 Serial, 1 Parallel, & 1 Game Ports
- Enhanced 101-Key Keyboard
- Hi-Resolution 400DPI Serial Mouse
- Microsoft DOS 5.0 & Windows 3.1

486/33 DX \$2745  
486/50 DX2 \$2945

- Above System with 12"x12" Digitizer Add \$330
- 32-Bit Local Bus Hard Disk Controller Add \$60



W

HEN IT COMES TO HIGH-SPEED EISA PERFORMANCE, COMTRADE IS FURIOUSLY BLOWING AWAY THE COMPETITION. "A VERY SWIFT GRAPHICS MACHINE," SAYS COMPUTER SHOPPER (MAY 1992). \* AND THIS HURRICANE EISA POWER IS FINALLY AVAILABLE TO YOU AT A PRICE THAT WON'T BLOW YOU AWAY. \* THESE EISA SYSTEMS FEATURE A POWERFUL 32-BIT EISA HARD DISK CONTROLLER THAT PROVIDES REAL 32-BIT ACCESS TO THE HARD DRIVE. THE RESULT IS A 350% FASTER DATA TRANSFER RATE (DTR). \* COMTRADE 486 EISA SYSTEMS - THE ULTIMATE MACHINE THAT LETS YOU TAKE YOUR WORKLOAD BY STORM.

"Performance is the Comtrade's strong point."

"Excellent Design"

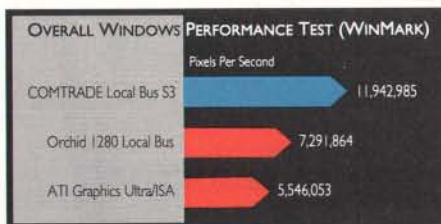


"The Comtrade 486 EISA Win Station already has the performance issue licked."

## Comtrade Local Bus Wins Big!

In Comparison With Other Leading High Performance Super VGA.

INTRODUCING COMTRADE'S 32-BIT LOCAL BUS. \* TRADITIONALLY, 486 ISA MACHINES COULD ONLY SUPPORT 16-BIT VIDEO CARDS AND RUN AT STANDARD 8MHZ BUS SPEED. \* THAT WOULD RESULT IN A BOTTLENECK REGARDLESS OF HOW FAST THE CPU COULD RUN. \* NOW YOU HAVE AN ALTERNATIVE. \* COMTRADE'S LOCAL BUS SYSTEM USES A 32-BIT VIDEO CARD WHICH NOT ONLY PROVIDES DOUBLE THE DATA PATH, BUT ALSO THE VIDEO BUS RUNS AT TRUE CPU SPEED. \* THE RESULT IS VIDEO SPEED UP TO 5X FASTER THAN REGULAR SVGA AND UP TO 50X FASTER WITH OUR LOCAL BUS S3 VRAM GRAPHICS ACCELERATOR.



Source: COMPUTER SHOPPER, July 1992, Local Bus Video Review, Page 184.



Circle 447 on Inquiry Card (RESELLERS: 448).

30 Day Money Back Guarantee. Unconditional Two-year Parts Warranty. One Year On-Site NationWide Service.

### 486 EISA Advantage

- 64K Super Fast Write-Back Cache SRAM
- 4MB RAM & Built-in 487 Math Coprocessor
- 1.2MB 5.25" & 1.44MB 3.5" Floppy Drive
- Optional 32-Bit EISA Hard Disk Controller
- 130 MB 15ms IDE Drive with 64K Cache
- 16-Bit 1024x768 SVGA Card with 1MB RAM
- 14" Non-Interlaced .28mm SVGA Color Monitor (VESA Standard for 72Hz Flicker-Free Display)
- 2 Serial, 1 Parallel, & 1 Game Ports
- Enhanced 101-Key Keyboard
- Hi-Resolution 400DPI Serial Mouse
- Microsoft DOS 5.0 & Windows 3.1

486/33 DX \$1875  
486/50 DX2 \$2055  
486/50 DX \$2175  
486/66 DX2 \$2375

- 8MB RAM & 210MB Drive Upgrade Add \$320
- 510MB Hard Drive & EISA Controller Add \$60

### Local Bus SVGA

- 64K Super Fast Write-Back Cache SRAM
- 4MB RAM & Built-in 487 Math Coprocessor
- 1.2MB 5.25" & 1.44MB 3.5" Floppy Drive
- 130MB 15ms IDE Drive with 64K Cache
- 32-Bit Local Bus Turbo ET-4000 Card w/ 1MB VRAM (Up to 1280x1024 & up to 32768 Colors) (5 times faster than standard super VGA)
- 14" Non-Interlaced .28mm SVGA Color Monitor (VESA Standard for 72Hz Flicker-Free Display)
- 2 Serial, 1 Parallel, & 1 Game Ports
- Enhanced 101-Key Keyboard
- Hi-Resolution 400DPI Serial Mouse
- Microsoft DOS 5.0 & Windows 3.1

486/33 DX \$1725  
486/50 DX2 \$1925

- 8MB RAM & 210MB Drive Add \$320
- 32-Bit Local Bus Hard Disk Controller Add \$60

1.800.969.212

**COMTRADE**

"Where Quality is Everything"

International 818.961.6688

Japan 0473.34.3700

Fax 818.369.1479

Hours: 7:00-7:30 Pacific Mon-Fri

9:00-6:00 Pacific Sat

15314 East Valley Boulevard

City of Industry, California 917





# The difference between their prices and ours is simply too great to ignore. No wonder we've been around **SINCE 1984**

(AND WHAT AUDACITY THE COMPETITION HAS TO CLAIM THAT THEY WON'T BE UNDERSOLD)

**"DETERMINED TO BE BEST / DESTINED TO BE FIRST"**

## TOSHIBA MEMORY

T2200SX, T2000SX, T2000SX  
T2000, T5100, T3100SX, T3200SX  
T1600, T1200XE, T1000XE/SE/LE

2MB...\$ 77  
4MB...\$156  
6MB...\$218  
8MB...\$320

\*ALL CARDS  
ARE FAST 70ns

## PCMCIA SRAM MEMORY

DEC PALMTOP, DELL 320SLI SUB-NOTEBOOK, GRID GRIDPAD,  
HP 95LX, IBM PC RADIO, MOMENTA PENTOP, NCR 3125 NOTEPAD  
POQET, SHARP PC3000/3100, SHARP PC-6700/6741/6781/6785,  
SHARP PC-6800/6841/6881, TOSHIBA T3300SL, AND MORE  
512K \$114 1MB \$162 2MB \$351

## COMPAQ LAPTOP MEMORY

CONTURA 2MB/4MB/8MB \$111/\$202/\$364  
LTE386s/20 1MB/4MB \$ 88/\$198  
LITE/20 & LITE/25 1MB/4MB/8MB \$ 88/\$198/\$336

## SHARP PC-6781

80MB HDD W/ 8MB \$2059  
120MB HDD W/ 8MB \$2436

MATH COPROCESSORS  
80C287-10/12 \$58  
80387SX-16/20/25 \$78  
80387DX-20/25/33 \$78

NORTON ANTI-VIRUS V2.0  
FOR DOS & WINDOWS \$58

## UPGRADED NOTEBOOKS

AST PREMIUM EXEC 386SX/25 120MB W/ 8MB RAM	\$1944
SHARP PC-6340/40MB W/ 2MB RAM	\$1198
SHARP PC-6861/80MB COLOR W/ 8MB RAM	\$4189
SHARP PC-6861/120MB COLOR W/ 8MB RAM	\$4568
TEXAS INSTRUMENTS TM3000/120MB W/ 6MB RAM	\$2278
TOSHIBA T2200SX/80MB W/ 10MB RAM	\$2527
TOSHIBA T3300SL/120MB W/ 18MB RAM	\$3541
TOSHIBA T4400SX/120MB LCD W/ 18MB RAM	\$3076
TOSHIBA T4400DX/120MB LCD W/ 18MB RAM	\$4295
TOSHIBA T4400SX/120MB PLASMA W/ 18MB RAM	\$4238
TOSHIBA T4400DX/120MB PLASMA W/ 18MB RAM	\$4557
TOSHIBA T4400SX/120MB COLOR W/ 20MB RAM	\$5809
TOSHIBA T4400DX/120MB COLOR W/ 20MB RAM	\$6128
TOSHIBA T6400SX/120MB W/ 20MB RAM	\$4830
TOSHIBA T6400SX/120MB COLOR W/ 20MB RAM	\$7272
TOSHIBA T6400DX/200MB W/ 20MB RAM	\$5833
TOSHIBA T6400DX/200MB COLOR W/ 20MB RAM	\$8275
TOSHIBA T4400SX/T6400SX DX UPGRADE KIT	\$ 308

## LAPTOP/NOTEBOOK MEMORY

AST PREMIUM EXEC 4MB (70ns LP)	\$120	WOW!
COMMODORE CLT286/386 2MB (70ns LP)	\$77	
COMPAQ SLT/286 4MB	\$328	
COMPAQ SLT/386S 4MB	\$218	
COMPUADD COMPANION/SX 2MB (70ns)	\$58	
EVEREX TEMPO/LX 2MB/4MB (70ns LP)	\$77	
GRID 1720/1750 2MB	\$88	
IBM N335X 2MB/4MB (70ns LP)	\$98/\$158	
IBM CL575X 4MB/8MB (70ns LP)	\$288/\$540	NEW!
IBM N51SX/N51SLC 2MB/4MB/8MB	\$CALL	NEW!
NEC ULTRALITE 286 4MB	\$208	
PANASONIC C170/270/370 1MB/2MB	\$58/\$88	
SANYO MBC-17NB/18NB 2MB (70ns LP)	\$77	
SHARP PC-6600/6841/6881 2MB (70ns)	\$58	
SHARP PC-6700/6781/6785/6800/6881 2MB/4MB	\$CALL	NEW!
SHARP PC-8501 COLORSTAR 2MB	\$119	
TANDY 1500HD/2810HD/3810HD 1MB/2MB	\$58/\$88	
TI TRAVELMATE TM3000 2MB (70ns)	\$58	
TOSHIBA T3300SL 2MB/4MB/8MB/16MB	\$83/\$148/\$209/\$275	
ZEOS 286/386SX NOTEBOOK 2MB (70ns)	\$77	
ZENITH MASTERSPORT SX/SL/SLC 2MB (70ns)	\$77	WOW!

## DESKTOP MEMORY

AST 500510-008 4MB \$156	COMPAQ 113132-001 4MB \$158
AST 500780-004 4MB \$140	COMPAQ 112534-001 4MB \$158
AST 500780-001 8MB \$281	COMPAQ 118689-001 2MB \$ 77
AST 500780-005 2MB \$ 90	COMPAQ 118690-001 4MB \$158
IBM 6450128 4MB \$158	HP VECTRA 1542/1642 4MB \$158
IBM 6450128 8MB \$296	HP VECTRA 2404A 8MB \$296
IBM 6450130 8MB \$296	HP VECTRA 2152A 8MB \$296
IBM 6450603 1MB \$ 48	HP VECTRA 2151A 4MB \$158
IBM 6450604 2MB \$ 77	HP VECTRA 2381A 2MB \$ 88

## LASER PRINTER MEMORY

APPLE LASERWRITER II/INTX 4MB	\$143
AT&T 593 LASER 2MB/4MB	\$114/\$185
BROTHER HL-4/4V/4VPS 2MB/3MB/4MB	\$122/\$169/\$192
BROTHER HL-8/8D/8V 2MB UPGRADE	\$122
CANON LBP 6U/8U/8U/8U 2MB/4MB	\$104/\$174
C. ITOH-6 2MB/4MB UPGRADE	\$114/\$185
DATAPRODUCTS LZP650 1MB/1.5MB/2.5MB/4MB	\$108/\$150/\$182/\$308
EPSON ACTION LASER PLUS 2MB/4MB	\$114/\$185
EPSON ACTION LASER II 2MB/3MB/5MB	\$105/\$159/\$247
EPSON EPL-4100/8000 2MB/3MB/5MB	\$105/\$159/\$247
EPSON EPL-8000 2MB/4MB UPGRADE	\$114/\$185
EPSON EPL-7000 2MB/3MB UPGRADE	\$122/\$157
FACIT P6060 2MB/4MB UPGRADE	\$114/\$185
HP LASERJET II/II 2MB/4MB UPGRADE	\$104/\$174
HP LASERJET IIP/IIIP/III/IIID/IIIP 2/3/4MB	\$98/\$144/\$166
HP LASERJET FAX 1MB	\$78
HP LASERJET IIISI/PAINTJET XL300 1MB/4MB	\$49/\$134
HP DESIGN JET PLOTTER 1MB/4MB UPGRADE	\$49/\$134
HP DESKJET+500/500C 256K UPGRADE	\$52
IBM/LEXMARK 4019/4019a 2MB/3.5MB	\$109/\$168
IBM LEXMARK 4029 (ALL MODELS) 2MB/4MB	\$105/\$148
KYOCERA F800/800A/800T 2MB/4MB	\$133/\$203
KYOCERA F1200S/3300 2MB/3MB/4MB	\$148/\$191/\$218
MANNESMANN TALLY 905 2MB/4MB	\$114/\$185
NCR 6435 2MB/4MB UPGRADE	\$114/\$185
NEC SILENTWRITER 2 MODEL 90/290 /S60/S60P 2MB	\$128
NEC SILENTWRITER 2 MODEL 95 /S62P 2MB	\$118
OKIDATA OKILASER/400 2MB UPGRADE	\$94
OKIDATA OKILASER 800/820 2MB/3MB/4MB	\$118/\$169/\$186
OKIDATA OKILASER 810 2MB/4MB UPGRADE	\$139/\$209
OKIDATA OKILASER 830/840 2MB UPGRADE	\$150
OLIVETTI PG-108/208 2MB/4MB UPGRADE	\$104/\$174
PACKARD BELL PB-9600 2MB/4MB UPGRADE	\$114/\$185
PANASONIC KX-P4410/4430 2MB/3MB/4MB	\$129/\$182/\$199
PANASONIC KX-P4420/4451/44501 2MB/3MB/4MB	\$109/\$157/\$179
PANASONIC KX-P4450 1MB UPGRADE	\$104
PANASONIC KX-P4455 2MB UPGRADE	\$129
QMS P5410 2MB/3MB/4MB UPGRADE	\$122/\$169/\$192
QMS P5815/825 2MB/4MB/8MB UPGRADE	\$156/\$226/\$296
QMS P51700 1MB/4MB UPGRADE	\$49/\$134
SHARP JX-9500/9700 1MB/1.5MB/2.5MB/4MB	\$108/\$150/\$182/\$306
SHARP JX-9500PS POSTSCRIPT 1MB UPGRADE	\$58
STAR LASER PRINTER 8 2MB/4MB UPGRADE	\$138/\$208
STAR/STARSCRIPT 4/III 2MB/4MB UPGRADE	\$147/\$233
TEC 1305B 2MB/4MB UPGRADE	\$114/\$185
TI MICROLASER (ALL MODELS) 1MB	\$58
TOSHIBA PAGELASER 2MB/4MB UPGRADE	\$114/\$185
UNISYS AP9210 2MB UPGRADE	\$109

**NOTE: ALL MEMORY UPGRADES COME WITH THE MEMORY BOARD AND THE MEMORY CHIPS ALREADY INSTALLED.**

WE ARE LISTED IN THE TOSHIBA  
TECHNICAL INFORMATION GUIDE  
AS "THE LEAST EXPENSIVE  
MEMORY MANUFACTURER  
APPROVED FOR TOSHIBA  
LAPTOPS AND NOTEBOOKS" !!!

TOSHIBA T5200/T8500  
2MB/8MB \$88/\$297

TOSHIBA T4400SX/T6400  
2MB/4MB/8MB \$126/\$157/\$291

\$78

1MB RAM UPGRADE  
SHARP PC-6220  
TI TRAVELMATE TM2000  
COMPUADD COMPANION

HDD UPGRADES  
40MB/60MB/80MB/120MB  
\$221/\$268/\$364/\$494

EVERYONE ELSE CLAIMS THEY  
WILL BEAT ANY PRICE. WE DON'T  
EVEN CLAIM IT. INSTEAD, WE JUST  
DO IT. YOU BE THE JUDGE!

TOSHIBA T5200  
200MB HDD UPGRADE  
\$698

IBM L40SX RAM UPGRADES  
2MB 4MB 8MB  
\$96 \$130 \$267

ALL MEMORY UPGRADES  
COME WITH A LIFETIME  
WARRANTY & A 48 HOUR  
EXCHANGE GUARANTEE!

APPLE POWERBOOK  
2MB.....\$103  
4MB.....\$180  
6MB.....\$246  
\*4MB & 6MB FOR MODEL  
100 SLIGHTLY HIGHER

SE HABLA ESPANOL  
pregunte por Hector

# tote-a-lap

550 Pilgrim Drive, Ste.F, Foster City, CA 94404  
PHONE: (415)578-1901 FAX: (415)578-1914  
ORDERS ONLY: 1-800-9-LAPTOP  
(PRIOR APPOINTMENTS ARE NEEDED FOR WILL-CALLS, PLEASE)

TERMS AND CONDITIONS: All sales final. We charge a 25% re-stocking fee on all re-fused shipments and pre-approved returns. Prices are subject to change w/out notice, and reflect all cash discounts. Warranty on all merchandise, except memory upgrades, is thru the original manufacturer only, unless previously agreed upon and stated on our invoice. All software, plus all merchandise that include a rom bios, are not returnable for credit, and are subject to an even exchange only. We accept purchase orders from credit-worthy institutions, although prices may be slightly higher on some items. We will not ship to any account with an overdue balance. Purchase prices at the time of sale are final.



## Accessories/Supplies • Add-In Boards

## Polaroid



Polaroid's Circular Polarizing Filters for computer monitors combine circular polarizer technology with optical quality materials and coatings to provide the ultimate in glare reduction and contrast enhancement. Polaroid CP-Filters suppress up to 99% of reflected light and are more effective than any other filter for improving contrast. Also, most CP-Filter models have a transparent electrically conductive coating which reduces up to 98% of the electromagnetic radiation and eliminates static.

Polaroid produces a full range of optical quality anti-glare filters in glass and triacetate to fit most 9"-21" monitors.

Polaroid Corporation, Polarizer Division,  
N2, 1 Upland Road, Norwood, MA 02062  
1-800-225-2770 Fax 617-446-4600

Circle 286 on Inquiry Card.

## Industrial PCs and Data Acquisition



- Industrial Workstation and Monitor
- Industrial Computer Chassis
- All-in-one Plug-in CPU Card
- RAM/ROM Disk Card

\*Free 114 Pages Master Catalog for Your Inquiry\*



AXIOM TECHNOLOGY, INC.  
13925 Magnolia Avenue Chino, CA 91710, U.S.A.  
TEL: 714-464-1881 • FAX: 714-464-1882

- Data Acquisition & Control Series
- Industrial I/O Series
- IEEE-488 Interface Card
- 8/16 Port RS232 Interface Card

\*Application Software Package

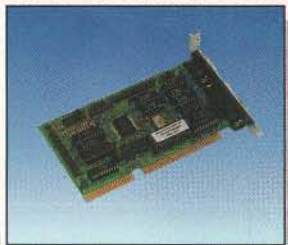
Circle 303 (RESELLERS: 304) on Inquiry Card.

## Add-In Boards

## 2.88MB Solutions for DOSs and OS/2

## FEATURES:

- 1.Support 2.88M / 1.44M / 720K / 1.2M / 360K floppy disk drives.
- 2.Compatible to DOS 3.x/4.x/5.0 ,OS/2 2.0 DR.DOS 6.0.
- 3.Formatting operation with DOS command.
- 4.Can diskcopy 5 1/4" diskettes to 3 1/2" diskettes.
- 5.Can boot from any floppy drives.
- 6.Non DOS trapped switch for UNIX and CP/M OS.
- 7.Can exist with any other FDC and HDC.
- 8.Support 4Mb drives as TOSHIBA ,TEAC old & new and PS/2 spec.



OEM and Distributor Welcome



CHIA SHIN TECHNOLOGY CORP

1F NO. 24, ALLEY 2, LANE 76, SEC. 6, SHIN YI RD. TAIPEI, R.O.C.  
FAX: 886-2-7270804  
TEL: 886-2-7263859 / 7271861

Circle 319 (RESELLERS: 320) on Inquiry Card.

# ROMDISK™

## New PCE/2-SR SRAM Emulator

Disk and Drive Emulators



- Multiple models, EPROM, Flash, battery backed SRAM technologies
- Capacities from 180K to 14MB, Single and Dual disk emulation under MS DOS
- Autobooting—on-board programming

418 West County Road D  
St. Paul, MN 55112

**CURTIS, INC.**

MS DOS is a trademark of Microsoft

612/631-9512  
FAX 612/631-9508

Circle 266 on Inquiry Card.



# HOT PRICES!

## ESAMOTHERBOARDS

- 486DX-50MHz w/256K Cache \$1050
- 486DX2-50MHz w/256K Cache LOW
- 486DX-33MHz w/256K Cache LOW

## LOCALBUSMOTHERBOARDS

- 486DX-50MHz w/256K \$830
- 486DX2-50MHz w/256K LOW
- 486DX-33MHz w/64K LOW

## Local Bus Video Cards

- 32-bit S-3 Window Accelerator 1MB \$225
- 32-bit ET-4000 w/1MB \$129
- 32-bit ET-4000 w/True-Color (16.7 million colors) w/1MB \$159

## MOTHERBOARDS

- 486DX-33MHz w/64K Cache \$499
- 486SX-25MHz \$249
- 386DX-40MHz w/64K Cache \$199

## SIMMs

- 1MB x 9 -70/60/50ns Lowest
- 4MB x 9 -70/60/50ns Lowest

## ALSO AVAILABLE

Floppy Drives, Tape Drives, Ethernet Adapters, Keyboards, Monitors, Hard Disks, Video Adapters, EISA controllers, etc.

510

## LAPTOP &amp; NOTEBOOK MEMORY

- Toshiba 1000, 2000, 2200, 3300, 4400, 6400 Series
- Toshiba 1200, 1600, 3100, 3200, 5200, 8500 Series
- 1MB/2MB/3MB/4MB/8MB/16MB FROM \$89

## COMPAQ LTE, LTE/LITE, SLT

- APPLE POWERBOOK, AST, AT&T BONDWELL, EPSON, EVEREX, GOLDSTAR, HP PALMTOP, IBM, LIBREX, LEADING EDGE, MAGNOVOX, NEC, PACKARD BELL, POQET, SAMSUNG, SONY, SHARP, TI, ZENITH

## LASER PRINTER MEMORY

- HP LASERJET II, IIO, IIP, IIP+, III, IIP, IIO, IIS
- 1MB/2MB/3MB/4MB FROM \$52
- Panasonic, Oki, Epson, Toshiba, Brother, C-Itoh, NEC, Sharp, QMS, Star, TI, etc.

## FAX/MODEMS

- 9600/2400bps w/V.42bis INT./EXT. \$69/\$119
- 9600/9600bps w/V.42bis INT./EXT. \$295/\$345
- 14,000/14,000bps w/V.42bis INT./EXT. \$345/\$395

**ATLAS INDUSTRIES, INC.**  
1-800-ATLAS-11 (285-2711)

(310) 478-6920 FAX (310) 479-2334  
11601 Wilshire Blvd., Suite 1820, L.A., CA 90025

All products new with a 1 to 5 year warranty. VISA, M/C, Discover, COD.  
Prices subject to change. Usually lower when you call!

Circle 314 on Inquiry Card.

\$289 /kit  
plus S & H

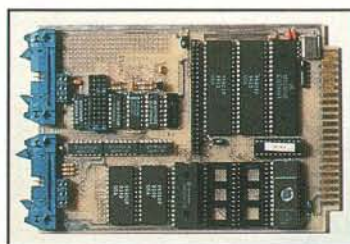


EasyMount TOUCHSCREEN kit includes:

- A transparent flat touch plate, sensitive to pressure.
- A controller card, 4"x4" in size, fits into PC bus slot.
- Diskettes provide educational programs, demos, C-callable routines, keyboard and mouse emulators, calibration and coding examples.
- Mounting hardware allows touch screen to be used with most monitors.
- Manual contains instructions for hardware installation, touch screen mounting, library function calls.

Hi-Tech Instruments, Inc., P.O. Box 1509, Stafford, TX 77497-1509 Ph: 713 - 980 - 9040 Fax: 713 - 980 - 4251

Circle 275 on Inquiry Card.



**6809 Single-Board Computer**



Wintek Corporation  
1801 South Street  
Lafayette, IN 47904

(800) 742-6809 or (317) 448-1903

6809 MPU, 2 serial ports, 4 parallel ports, RAM, EPROM, real time clock, watchdog timer, 44-pin 4.5" x 6.5" PCB. From \$139 to \$283.

**EXPANSION MODULES:** RAM/ROM, power I/O, analog I/O, serial I/O, parallel I/O, counter/timer, floppy disk, breadboard, and IEEE-488.

Circle 295 on Inquiry Card.



## PC/AT Four Port Com. Coprocessor

## GMM Sync4/CCP™

- High Performance 16 MHz 16 bit CPU.
- 80X86 code compatible.
- 4 Sync/Async Ports
- 2 Serial Ports with Full Duplex DMA.
- Uses Zilog 85C30, 85230 SCC chip.
- 512K Dual Ported Ram (STD)
- (1, 2, or 4 MEG Dual Port Ram - optional).
- 8k, 16k, 32k, 64k Window Size (Programmable).
- 8 Software Selectable and Shareable Interrupts.
- RS232/RS422/RS485
- Source Code Debugger Kit Available.



GMM Products Are All Made in USA.

PC/AT Dual Port Com. Coprocessor  
also available  
GMM Sync2/CCP™

**GMM**  
GMM Research Corporation

Other PC/AT & PS/2 8530 based products available.  
Extremely competitive pricing.

(714)752-9447 Fax (714)752-7335

18092 Sky Park South - Unit E, Irvine CA 92714

Circle 270 on Inquiry Card.

## NEW! SUPER FAST SPEED!

Order Toll-Free 1-800-282-4835



## PCSS-8F INTELLIGENT SERIAL COPROCESSOR

- The PCSS-8F is GTEK's newest, fastest serial coprocessor. With a real-time status port and a 24MHz processor, it boasts **two times** the data throughput of GTEK's popular PCSS-8L.
- Up to 128K bytes of *Dynamemory* for on the fly allocation and re-allocation of buffer memory. Does not use any computer memory.
- Eight RS-232 channels per card. (RS-485 or RS-422 optional)

OEM &amp; Dealer Inquiries Welcomed!

**GTEK** INC.

DEVELOPMENT HARDWARE & SOFTWARE  
P.O. Box 2310 • Bay St. Louis, MS 39521-2310 U.S.A.  
Order Toll-Free 1-800-282-4835 • Fax: 601-467-0935  
Mississippi & Technical Support 601-467-8048

Circle 272 on Inquiry Card.

Intelligent PrintShare  
SPECIAL OFFER - STARTER KIT

Everything you need to share your printer with two computers is included. (1) printer transmitter, (2) computer receivers, (2) 25 ft interconnect cables and a manual. Allows expansion up to 40 computers. Employs collision avoidance technology, intelligence detection, auto switching, no software required. Any topology wiring, uses popular 4 wire modular cables. PrintShare Kit as described \$239.50 + \$4.50 S&H. Additional computer adaptors with 25 ft. cable \$79.50, PP. Toll free ordering: 800-343-1455.



Call or fax for further information on this and also multi printer PrintShare network systems.

Call for FREE catalog!  
Specify - BYTE

AGENTS WANTED

**L-com**

Inc. TEL: 508-682-6936 FAX: 508-685-6467  
1755 Osgood Street, North Andover, MA 01845

Circle 302 on Inquiry Card.

## LET YOUR COMPUTER DO THE TALKING!

Integrated  
Voice/Fax Mail

integrates major voice/fax applications plus program control into one full-featured high performance software. PC-AT/386/486 based. Menu driven. Easy to use. Full support for Rhetorex, New Voice, Dialogic, TTI and Intel voice and fax hardware. Supports up to 24 voice lines and up to 8 fax lines.

Hardware + Software  
4 voice lines package starts at **\$950**

Tel: (818) 368-6132 Fax: (818) 368-7859

## SigmaTech Software

24 hours demo lines: 818-368-4566 or 818-368-8848  
10801 Bismarck Ave., Northridge, CA 91326 USA  
(Resellers/Dealers/OEMs/Private labels are welcome)

- Auto-Attendant
- Unlimited Audiotex
- Voice Mail
- Call Processing
- Telemarketing
- Fax Mail
- Fax-on-Demand
- Fax Broadcasting
- Party/Chat lines
- Talking Yellow pages

Circle 315 on Inquiry Card.



## Voice Mail • Telemarketing • Call Processing

Transform your PC/XT/AT/386 into a multi-line processing command center. Intelligently process your sales, inquiries, and messages. Complete package.

(Developer/OEM packages available)  
VISA—MC—AMEX—COD

**Multi-Line** (Voice Solution) **\$995**  
**SINGLE LINE** (Bignouth) **\$295**

For Sales or Information:

Call 1-800-685-4884

CALL: (510) 522-3800 • FAX: (510) 522-5555

**TALKING TECHNOLOGY, INC.**  
1125 ATLANTIC AVE. • ALAMEDA, CA 94501

Circle 290 on Inquiry Card.

## Single Board Computer

## SC486DX-33C



SC286-16MHz 1/2 size SBC  
SC386SX-25MHz 1/2 size SBC  
SC386DX-33MHz 64KB Cache SBC  
SC486DX-33MHz 64KB Cache SBC

## All include:

2 serial ports & 1 parallel port  
Floppy controller  
IDE hard disk interface  
Watch Dog Timer  
UNIX and DOS verified

## Also Available:

Industrial Rack-Mount PC Chassis  
Backplane: 4, 6, 8, 12, 14, 18, 20-slot

**ACI**

1-800-886-ACI-3

U.S.A.

TEL: 617-938-8020  
Fax: 617-938-8037

International

Tel: 886-2-7582571 (Taiwan)  
Fax: 886-2-7589615

Circle 309 (RESELLERS: 310) on Inquiry Card.

## AT Systems in ROM

- Single Board Computers
- Run DOS code from ROM
- PC Code compatible
- Large Memory space
- Backplane systems



- Develop code on a PC. Run on our CPU cards with DOS and code in ROM. Use off-the-shelf expansion cards.

- KS6: NEC V53 CPU (286eq), 5 serial, 2 Par, Clock, AT bus, Max 4M Ram, 2M Rom, 512K NV Sram. \$349 (q1-oem ver).

- KS3: V40 CPU, 3 Serial, 2 Par, Clock, Flop, Kbd. \$249 (q1).

303-444-7737 Fax 303-786-9983

655 Hawthorn Ave., Boulder CO 80304 U.S.A.

**KILA**

Circle 277 on Inquiry Card.

## Rackmount Solutions

## RACKMOUNT COMPONENTS - QTY 25 PRICING

Rackmount Chassis 19"x7"x17" \$183  
Rackmount VGA Monitors \$531  
Rackmount Monitor Shelf \$113  
Rackmount Keyboard Shelf \$88

## RACKMOUNT PLATFORMS - Qty 1 Pricing

RMS286-12 \$549 RMS386-33 \$1095  
RMS386SX-16 \$795 RMS486-33 \$1695

System Platforms include 7" Rackmount Chassis, 200W Power Supply, Motherboard, 1.0MB Memory, IDE, FDC, 2-Ser, Par, 1.2MB or 1.44MB Floppy Disk Drive, 1 Year Warranty

RACKMOUNT CHASSIS - 15 Models up to 20 Board Slots

SLOT CPU BOARDS - 486, 386, 386SX, 286

RACKMOUNT MONITORS - Super VGA and Monochrome

RACKMOUNT CABINET - Modular from 21" to 96" high

**VALLEY**  
TECHNOLOGY INC.

2468 Armstrong Street, Livermore CA 94550  
(510) 447-2030 FAX: (510) 447-4559



Circle 299 on Inquiry Card.



## 50 MHZ 80486 ISA/EISA 23 MIPS Faster than Compaq & Dell



**EISA/ISA**  
BABY SIZE  
MADE IN USA

### ISA SYSTEM BOARD

MODEL	CACHE	MIPS	OK Board	Base System
486DX/50	64K	23.0	1150	1350
486DX/50	64K	23.0	945	1145
486DX/33	64K	15.0	745	945
486SX/20	64K	9.0	480	680
386DX/40	64K	10.8	340	540
386DX/33	64K	8.3	330	530

### EISA UPGRADABLE BOARD

MODEL	CACHE	MIPS	OK Board	Base System
486DX/50	256K	23.0	1599	1799
486DX/50	256K	23.0	1399	1599
486DX/33	256K	15.0	1199	1399

All bare systems include a baby desktop, IDE 2s/1p, 101-keyboard, 200 Watt power supply. Tower system with 250 Watt power supply add \$150. FCC Class B, UL, TUV are available.

### FEATURES

- 64/256K Write Back Cache
- Burst Mode Design
- Shadow RAM on Video & BIOS
- 64MB 32 Bit Memory Expansion
- Baby-size with Eight Expansion Slots
- 100% UNIX, OS/2 & Novell Compatible
- One Year Full Warranty
- Made in USA

### FEATURES

- 256K Write Back Cache
- Burst Mode Design
- Upgradable Architecture (66 Mhz)
- 64MB 32-bit Memory Expansion
- Proprietary Local for Video
- 100% EISA/ISA Compatible
- One Year Full Warranty
- Made in USA

### 386SX with IDE/2s/1p

MODEL	BOARD	Base System
386SX/33	210	410
386SX/25	199	399
386SX/20	185	385

### TECHNOLOGY POWER ENT., INC.

47273 Fremont Blvd., Fremont, CA 94538  
Tel: 510-623-3818 FAX: 510-623-3840

All names mentioned above are trademarks of their respective companies. Prices are subject to change without notice.

Circle 291 on Inquiry Card.

NEW, FREE 288 PAGE DATA ACQUISITION & CONTROL CATALOG/REFERENCE GUIDE FOR IBM PC/XT/AT, PS2, MICROCHANNEL COMPUTERS AND COMPATIBLES.

NEW 1992 CATALOG



- \* A/D BOARDS
- \* SIGNAL CONDITIONING
- \* COMMUNICATION
- \* INDUSTRIAL CONTROL
- \* PC INSTRUMENTS
- \* SCIENTIFIC SOFTWARE

KEITHLEY METRABYTE  
DATA ACQUISITION

SEND TODAY FOR YOUR FREE 288 PAGE KEITHLEY METRABYTE CATALOG  
440 Myles Standish Blvd., Taunton, MA 02780 Tel: (508) 880-3000 TLX: 503989 Fax: (508) 880-0179

Circle 281 on Inquiry Card.

## 20-BIT A/D For PC/XT/AT & Compatibles

Linearity .0005 percent of full scale

**\$300** software included

### LAWSON LABS, INC.

74 4TH AVE. NW 800 321-5355  
KALISPELL, MT 59901 406 257-5355



Circle 279 on Inquiry Card.

## The Intelligent Solution For Data Acquisition



DAP 2400™ Data Acquisition Processor™

ANALOG I/O

DIGITAL I/O

- Inputs to 235K samples per second
- Outputs to 250K samples per second

FFT and FIR-filtering

Digital Signal Processing at 10 MIPS

16 MHz CPU with DRAM to 512K

20 MHz DSP with SRAM to 96K

DAP™ Operating System

- 100+ standard commands
- Custom commands in C

**MICROSTAR**

**LABORATORIES™**

2265 116th Avenue NE  
Bellevue, WA 98004  
FAX (206) 453-3199

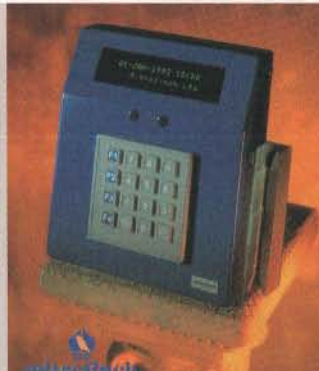
Send for FREE catalog.  
Or call us at (206) 453-2345

Circle 282 on Inquiry Card.

### Shop Floor Data Capture

## Terminal

The MF100 Shop Floor Data Capture Terminal communicates using ASCII file formats. With features such as RS 485 interface – up to 224K usable memory – magstripe, barcode, proximity or keyboard data entry – full operational battery backup – table download facilities etc. . . .



TEL 44 904 693115 FAX 44 904 693792

Circle 323 on Inquiry Card.



### MiniSCSI Plus PARALLEL-TO-SCSI ADAPTER

## WANT BETTER CONNECTIONS?

CONNECT UP TO 7 SCSI DEVICES AND A PRINTER TO YOUR PARALLEL PORT!

Up to twice as fast as our original MiniSCSI, the MiniSCSI Plus lets you run a CD-ROM, tape drive, SCSI hard disk, SyQuest, Bernoulli or other SCSI device from almost any parallel port (tape software optional). For most notebook users, it's the only way to use SCSI CD-ROMs and tape drives. Plus, its integrated cable makes it a snap to move and share SCSI devices between desktops and notebooks.

Call For Details!  
(510) 770-1400



Trantor Systems, Ltd.  
5415 Randall Place  
Fremont, CA 94538-3151  
FAX: (510) 770-9910

© 1992 Trantor Systems Ltd. MiniSCSI and MiniSCSI Plus are trademarks of Trantor Systems Ltd. All other product names are trademarks of their respective companies.

Circle 298 on Inquiry Card.



## Connect with the Parallel Universe

### SIGEN 250MB PORTABLE PARALLEL PORT TAPE BACKUP

No controller card required. Connects to parallel port. Installs in less than 3 minutes. Great for Laptops. To 9.5 MB/min transfer rate.

**Capacity**  
20 MB Parallel Port Floppy  
80/250 MB 1/4" cartridge 4.5 MB/min  
60/200 MB 1/4" cartridge 9.5 MB/min  
250/500 MB 1/4" cartridge 9.5 MB/min  
1.3 GB 1/4" cartridge SCSI 18 MB/min  
1.2 / 2 GB 4mm DAT SCSI 10MB/min

**Supports**  
DOS, OS/2  
Novell 286, 386  
UNIX, XENIX

Industry standard SYTOS PLUS, or CENTRAL POINT BACKUP software and for file server based NLM and VAP TAPEWARE.



PHONE (408) 737-3904 • FAX (408) 737-3910

Circle 292 on Inquiry Card.

IBM • TATUNG • PANASONIC • ZEOS • SHARP • NORTHGATE • HYUNDAI • AST • SANYO • LEADING • EDGEE • DTK • SUPREMACY

## ROM BIOS UPGRADES

### Solve Your Compatibility Problems!

AMI Solutions for all your upgrade needs  
WE STOCK THE LARGEST VARIETY OF ROM BIOS UPDATES IN THE WORLD

**FEATURES OF A NEW BIOS**

- Support, 1.2MB, 1.44MB & 2.88MB floppy drives
- Windows 3.1 support
- Novell support
- DOS 5.0 Support
- IDE drive support
- OS/2 support
- Support for 47 different hard drives, plus 2 user defined
- Virus & password protection and more!!!

FREE Catalog FREE 1 Year Update  
FREE Chip Puller FREE Tech Support  
Volume DISCOUNTS Dealers Welcome Corp & Univ. P.O.'s are Welcome Same Day Shipping

**WE ALSO SELL MOTHERBOARDS & MEMORY PRODUCTS**

GATEWAY • EPSON • TANDY • DELL • NCR • EVEREX • COMPAQ • NEC • WYSE

Circle 308 on Inquiry Card.

## Memory Superstore . . . your direct source.

For the absolute best price & service call (800) 800-7056.

Standard SIMMS	
4MB x 9-80/70 ***	\$110.00
4MB x 9-60	\$114.00
256K x 9-80/70	\$11.00
1MB x 9-80/70 (9 chip)	\$34.50
1MB x 9-80/70 (3 chip)	\$31.00
1MB x 36-70*	\$145.00
2MB x 36-70*	\$262.00
4MB x 36-70* ***	\$499.00
Call for best price on a 30-pin & 72-pin Modules, 2, 4, 8 & 16MB	
* used in PS/2, Compaq, Dell & other high-end systems (386 & 486) 4 piece minimum	
Laser Printer Memory	
Canon	
LBP 8II/8IIR/8IIT	4MB \$118.00
Epson Action Laser	2MB \$125.00
Action Laser II	2MB \$138.00
HP LaserJet IIP, IIPPIs, III, IIID, IIP, II, IID, IISi	
2MB	\$99.00
4MB	\$172.00
HP DeskJet	256K \$78.00
IBM 4029 ***	4MB \$140.00
Sharp JX9500PS	1MB \$75.00
OKI Laser QL400	2MB \$116.00
OL800/820	2MB \$135.00
	4MB \$210.00
Panasonic	2MB \$135.00
KXP4420, 4450I	
KXP4455	2MB \$175.00
KXP4410	4MB \$215.00
IBM & Compaq Memory	
PS/2, 355X/LS, 40SX, 50Z, 55SX/LS, 57SX, 65SX/LS, 70, 70A21, B21, B61, 90, 95	
2MB \$89	4MB \$145
8MB \$268	
DeskPro386/20, E25, S/16, N, SX20, 33M	
2MB \$89	4MB \$145
8MB \$268	
Workstation Memory	
Sun EPC/IPX ***	16MB \$470
Dell 486	16MB \$495
IBM RS6000	16MB \$620
HP Apollo	16MB \$675
Silicon Graphics	16MB \$620
Next	16MB \$470
Laptop/Credit Card/Flash Memory	
Apple Power Book	4MB \$230
AST Premium Exec.	4MB \$160
AT&T Safari	4MB \$345
Bondwell B310	1MB \$136
Compaq	
LTE386s/20	1MB \$82
4MB \$259	
LTELite/20.5	2MB \$140
4MB \$240	
	8MB \$578
LTE/286	1MB \$88
2MB \$138	
SLT/286	1MB \$88
4MB \$240	
Goldstar GS520	4MB \$330
HP 95LX, Pojet PC, Grid Pad	
SRAM Card	256K \$122
	512K \$149
Flash Memory	1MB \$238
	2MB \$309
Packard Bell, Magnavox, Mitsubishi ***	
2MB \$150	4MB \$290
Toshiba - T1000SE/LE/XE, T2000SX, T1000LE, T2200-SX, T2000SX	
1MB \$80	2MB \$109
4MB \$230	8MB \$430
Toshiba - T1200XE	2MB \$88
Toshiba - T4400 SX/SXC, T3300, T6400	
2MB \$182	4MB \$329
6MB \$469	8MB \$670
Zenith Masters SL	2MB \$122

**Memory Superstore** (800) 800-7056 OR (805) 339-0305 FAX (805) 339-0353  
Small Business  
Volume Discounts for Corporations, VARs, Government and Universities.

Circle 301 on Inquiry Card.

## Make Your Image Fly !

### Capturing, Compression and Printing.

**Video Blaster, Full Motion, True Color, Windowing Video Capture & Sound Controller**

\*3 Switchable NTSC/PAL Video Inputs  
\*720x512 Digitized Video Resolution  
\*D/A Sound Mixer & Volume Control  
\*Mixed Amplified Stereo Output of 0.5W  
\*Versatile Utility for Captured Video Image Manipulation, Editing, Storage, Retrieval



\$329

\*Windowing controlled by Independent X-Y coordinates & by Color Keying  
\*Independent X-Y Scaling  
\*Lots of Bundled Software!  
\*MS-Dos & Windows 3.X  
Dynamic Link Library Available

**Picture Packer, 30:1 Image Compression Software for Windows 3.0**

\*Dramatically Saves Precious Hard Disk Space by 30:1 with Minimum Image Quality Loss and 5:1 with NO Image Quality Loss  
\*Supports Full Color or Gray-Scale Image Files  
\*Supports Windows 3.0 and MS-DOS 5.0  
\*Adheres to JPEG Standards  
\*Compatible with All Major Graphic File Format: TIFF, TARGA, PCX, GIF



\*Memory-Resident Program Operates Transparently within Popular Applications such as:  
-Aldus Pagemaker  
-PhotoStyler  
-Picture Publisher  
to automatically Access and Decompress Picture Files  
\*Affordable Price of \$99.00 with \$99.00 Coupon Toward Purchase of Packer Card

**WinPrinter, Cost Effective 800 DPI Laser Printing**

\*Host-Based Processing. The More Powerful Your Computer, The Faster the Printing Speed.  
\*Made-for Windows Printing  
\*Printing Versatility - 3 Ways with:  
- Windows Direct Driver, PostScript Emulator, PCL4  
\*800 DPI Laser Printing - 4 Page-Per Minute  
\*Upgrade Kit for your HP LaserJet Series Printers Available



For Order, Catalog and Price Quotes Call:

**1-800-446-1967**

**Empire Computech**

9668 Hermosa Ave.  
Rancho Cucamonga, CA 91730  
Tel: 714-466-1400 Fax: 714-466-1409

Mon - Fri  
9am - 5pm



All trademarks are trademarks of their respective owners

Circle 312 on Inquiry Card.

Let your  
"true colors shine  
through"  
when you advertise your  
computer products in  
BYTE's

## HARDWARE/SOFTWARE SHOWCASE

our newest, affordable,  
4-color advertising section!

Call for more details:  
(603) 924-2695  
or (603) 924-2598

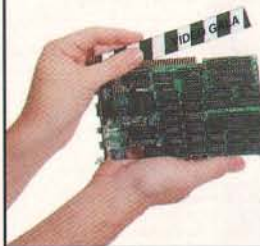


## VIDEO FRAME GRABBERS

RECORD TO VCR AND TV MONITORS. PC/XT/AT, PAL/NTSC

**VGA VIDEO GALA** .....\$695.00 Three boards in one: 1) It's a Super VGA card which replaces your existing card. 2) It has recordable output to VCRs & TVs. 3) Live TV/VCR video on your VGA monitor and frame grabbing in 24-bit color.

**HRT 512-8** .....\$995.00 Real time, grey scale frame grabber. This is a multifeatured high performance industrial model. (LUT, overlay, external trigger, EX/IN, pixel clock, genlockable, optional square pixels, video output...) Applications include machine vision, medical imaging, robotics, microscopy etc. Resolution is 512 X 512 with 256 levels of grey (optional 2nd buffer or 640 X 512 res). Rock-solid capture even from a VCR. Library of image processing routines included free. 100+ functions such as histograms, convolutions, edge detection, point and area operations, arithmetic and logical operations between frames, board control, IO, etc.



**HIGH RES**  
TECHNOLOGIES INC.

P.O. Box 76, Lewiston, New York 14092 U.S.A.  
Tel: 416-497-6493 Ext. 103 Fax: 416-497-1636 Dept. 103

Circle 274 on Inquiry Card.

# PLC

"High speed scan rate at a fraction of the cost"

**HARDWARE:** • 8 optically isolated digital inputs at 12 or 24 VDC  
• 8 isolated relay outputs rated at up to 3A continuous at 120 VAC with a 10 A surge • SIZE: (9" L x 3.5" W x 1.5" D) • 106 internal bits • 8 K of EPROM  
• up to 1ms per K of boolean logic • serial communications optional

**100 GENERAL PURPOSE REGISTERS:** used for  
• timers • counters • pulsars • data storage • sequencers

**SOFTWARE:** • programmable with IBM XT/AT/386/486 compatible and EPROM programmer • ladder logic • text annotation • easy to use editor with menus and function keys

hardware \$139.00 software \$99.00 both for \$188.00

1-800-668-2707 tel: (519) 681-2818 fax: (519) 681-9822

**DAVISON • WORTH**  
CORPORATION

Circle 317 on Inquiry Card (RESELLERS: 318).



NEW!

## Virus Protection Power

The card that provides a comprehensive and continuous protection automatically!

Why choose the AVP card and not the leading anti-virus software?

Because unlike anti-virus software:

- AVP does not occupy RAM memory...
- AVP does not waste time scanning your drives...
- AVP is not vulnerable to viral infection...
- AVP provides an optional password to prevent the unauthorized use of your computer...
- AVP does not require software and therefore you will not need constant updates, nor can it be inadvertently deleted...
- AVP is easy to install, easy to use and easy to pay for!

The Card...don't leave your computer without it!

Order NOW  
for only: **\$59.95**  
plus tax if applicable plus S & H  
VISA, MasterCard accepted.  
Dealers Welcome



**GRANICOR**

Call 24 hours a day (415) 244-9999  
or fax your order to (415) 244-9279



## For Your Development Needs!



## MODEL 9000 EPROM PROGRAMMER

- QuickPulse and intelligent algorithms.
- Programs Eeproms (up to 4Mb), EEproms & MPU's.
- Up to 57K baud.
- Ultra Fast!

ORDER TOLL-FREE  
**800-282-4835**

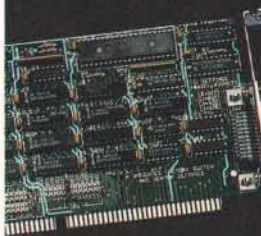
OEM & Dealer Inquiries Welcomed!

**GTEK** INC.

DEVELOPMENT HARDWARE & SOFTWARE  
P.O. Box 2310 • Bay St. Louis, MS 39521-2310 U.S.A.  
Fax: 601-467-0935  
Mississippi & Technical Support 601-467-8048

Circle 273 on Inquiry Card.

## IEEE 488.2



Hardware for IBM PC/AT, Micro Channel, Sun, Macintosh, DEC, and NeXT.

Software for DOS, Windows, UNIX, VMS, menu- and icon-driven environments.

IEEE 488 extenders, analyzers, converters, analog I/O, and digital I/O.

Call for your free IEEE catalog

**IOtech**

IOtech, Inc. • 216.439.4091 • Fax 216.439.4093

Circle 276 on Inquiry Card.



## Melts the Price of 8051 ICE

Only \$851 for iceMASTER-PE

New AET (patent pending) emulator architecture delivers incredible value!

- Up to 40 MHz Operation
- 64K Emulation Code Memory
- 64K External Data Memory
- 128K Hardware Breakpoints
- 16K Trace Memory
- Transparent Trace (View Trace While Executing)
- Real Time & Nonintrusive
- Symbolic & Source-Level Debug
- Built-In Self-Test
- Windowed User Interface
- Serial Link to Any PC
- Performance Analyzer
- Macro Cross Assembler
- Supports 8031/8032's
- Supports 8XC751/8XC752's

Call today for FREE DEMO DISK! (800) 638-2423

MetaLink Corporation P.O. Box 1329 Chandler, Az 85244-1329  
Phone: (602) 926-0797 FAX: (602) 926-1198

Circle 306 on Inquiry Card.

POWERFUL • AFFORDABLE INSTRUMENTS

## 200 MHz Logic Analyzer



- 400 MHz max sampling rate
- up to 128 channels
- 16K samples/channel
- 16 level triggering
- Variable threshold voltage
- Sophisticated triggering
- FREE software updates

\$799 - LA12100 (100 MHz)

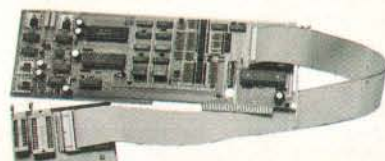
\$1299 - LA32200 (200 MHz-32-ch.)

\$1899 - LA32400 (400 MHz-32-ch.)

Price is complete.  
Pods and software included.

## Universal Programmer

PAL  
GAL  
EPROM  
FLASH  
EEPROM  
PROM  
87xxx...



\$475

- 16V8, 20V8, 22V10, GALs
- 26V12, 20RA10, 18V10 GALs
- 2716-27040 EPROMs
- 87xxx MICROs
- EEPROMs (incl. 8 pin serial)

- 16 bit EPROMs
- Byte Split/Merge (16 & 32 bit)
- JEDEC, INTEL HEX, Motorola 'S' files
- Dallas NVS RAM programming
- FREE software updates on BBS



Call - (201) 808-8990  
**Link Computer Graphics, Inc.**

369 Passaic Ave., Suite 100, Fairfield, NJ 07004 FAX: 808-8786

Circle 280 on Inquiry Card.



UNIVERSAL PROGRAMMER, EMULATOR, & TESTER

TUP-400 \$745.00 NEW  
TUP-300 \$575.00

- New Improved hardware and software.
- The most complete PC-based Universal Programmer, Programs PLD (PAL, GAL, FPL, EPLD, PEEL, MAX, MACH...), E(E)PROM, (up to 16Mbit), Flash EPROM, BIPROM, Special PROM, MPU (87XX, 68XX, Z8, PSD301, PIC16XX, TMS320EXX, UPD75PXX, HD637XXX...).
- Covers DIP, PLCC, QFP, SOP, and PGA with 8 to 84 pins. Gang Programming adapters available also.
- EPROM EMULATION capability.
- Tests digital ICs and DRAMs (SIMM/SIP adapter available).
- Free software updates and new device added upon request.
- IC Manufacturers' approval.
- 1-year warranty, 30-day money-back guarantee.

CALL TODAY FOR MORE INFORMATION.  
Distributors are welcome!



Tribal Microsystems Inc.

44388 S. GRIMMER BLVD., FREMONT, CA 94538

Tel (510) 623-8859

FAX (510) 623-9925



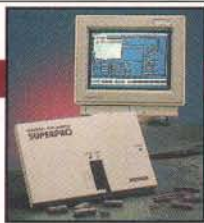
Supports: 68HCXXX MAX; PIC16XX  
DSP; PSD3XX; MACH.

Circle 293 on Inquiry Card (RESELLERS: 294).

**SUPERPRO®**  
now \$599 (US only)

Over 2,000 devices, desktop  
programmer for your IBM PC  
with high speed & reliability

- Easy to use menu driven Software.
  - Universal programming for E(E)PROM, Flash E(E)PROM, Bipolar PROM, PAL, FPL, PEEL, GAL, E(E)PLD, & Microcontroller, etc.
  - Test TTL/CMOS logic ICs, & memory (DRAM/SRAM).
  - Life time free Software updates on BBS & technical support.
  - 1 year Hardware warranty & 30 day money back guarantee.
  - Developed & made in U.S.A.
  - Call for demo disk.
- Distributors are welcome!!



E(E)PROM programmer to 4-Mbit  
● ROM MASTER: \$149  
E(E)PROM programmer 4 gang version  
● ROM MASTER/4: \$239  
757 N. Pastoria Avenue, Sunnyvale, CA. 94086  
(408) 524-1929  
FAX (408) 245-7084 BBS (408) 245-7082

**XELTEK**

Circle 296 on Inquiry Card.

**MICROCONTROLLERS**

- C Programmable
- Data Acquisition
- Control / Test
- Excellent Support
- From \$159 Qty 1
- New Keyboard Display Modules

Use our Little Giant™ and Tiny Giant™ miniature controllers to computerize your product, plant or test department. Features built-in power supply, digital I/O to 48+ lines, serial I/O (RS232 / RS485), A/D converters to 20 bits, solenoid drivers, time of day clock, battery backed memory, watchdog, field wiring connectors, up to 8 X 40 LCD with graphics, and more! Our \$195 interactive Dynamic C™ makes serious software development easy. You're only one phone call away from a total solution.

**Z-World Engineering**

1724 Picasso Ave., Davis, CA 95616 (916) 757-3737 Fax: (916) 753-5141  
Automatic Fax: (916) 753-0618 (Call from your fax, request catalog #18)

Circle 297 on Inquiry Card.

**9 Track/3480 Tape Subsystems**  
**1/4" DAT 8mm Optical**

- Best Quality
  - Lowest Prices
- 800/1600/3200/6250 BPI  
CALL 1-800-859-8856



**Laguna Data Systems**

23151 Alcalde Drive, Suite B-3, Laguna Hills, CA 92653  
Tel: 714-586-3010, Fax: 714-586-5538



Circle 278 on Inquiry Card.

**THE BEST IN  
9-TRACK?  
WELL, WE HATE  
TO BOAST.**

Ask  
about 3480



But, if you insist...

**800-729-8725**

**OVERLAND DATA®**

TEL: 619-571-5555 • FAX: 619-571-0982 • EUROPE: TEL: 49-6172-35027 • FAX: 49-6172-35028

Circle 284 on Inquiry Card.

**Desktop 9-Track Tape Subsystem**  
**#1-selling 9-track system on desktop.**



Qualstar's low cost 1/2-inch 9-track Streaming tape systems bring full ANSI data interchange to IBM AT, PS/2 or Macintosh, giving your micro the freedom to exchange data files with nearly any mainframe or minicomputer in the world.

Systems include DOS or Xenix compatible software, coupler card and cables. High reliability 1600 or 6250 BPI capability may be used for disk backup as well as data interchange.

**QUALSTAR®**

**Call us today! For details and  
to order: Fax (818) 882-4081  
Phone (818) 882-5822**

9621 Irondale Ave., Chatsworth CA 91311

©1989 Qualstar Corp.

All product and company names and trademarks are the exclusive property of their respective owners.

Circle 288 on Inquiry Card.

**LOST FOR THE WRITE WORD?**  
**Get it right with COLLINS ON-LINE**

French, German, Italian & Spanish  
bilingual dictionaries for your PC.  
40,000 references, 70,000 translations

**FEATURES INCLUDE:**

- ☐ **TSR** - memory resident so it can be used with most word processors for MS-DOS.
- ☐ **Look-up** - enables you to find words in the dictionary, choose the appropriate translations and paste them into your document quickly and easily.
- ☐ **Screen-read** - reads words in your document automatically for quick and accurate translation.
- ☐ **Annotate** - allows you to create your own specialized glossaries for use with Collins' world renowned bilingual dictionaries.

**PRICE £49 (Additional dictionaries £29)**



**HarperCollinsPublishers**

14 Steep Lane, Findon, Worthing, West Sussex  
BN14 0UF England  
Tel +44 (0)903 873 555 • Fax +44 (0)903 873 633

Circle 321 on Inquiry Card.

**EM320**

**WINDOWS**

**DEC VT320 Emulation for Microsoft Windows 3.X**

- 132 column display
- Cut and paste
- Kermit file transfer
- Windows style help
- Local or ANSI color
- Multiple instances
- Automatic window sizing
- Double high/wide characters
- LAT, INT 14 or TCP/IP support
- Modem dialer/Phone book
- Command language
- International character sets

**Diversified Computer Systems, Inc.** (303) 447-9251  
FAX (303) 447-1406 Other products: EM320 DOS, Tektronix 4105 DOS

Circle 268 on Inquiry Card.



## Free Data Acquisition Software Tool



DAQ Designer is a free software tool that helps determine which hardware and software combinations are best for your PC-based data acquisition system. DAQ Designer will (1) ask questions about your application, (2) analyze your answers to determine your system needs, and (3) describe what hardware and software you need to develop your data acquisition system.

## National Instruments

6504 Bridge Point Parkway  
Austin, TX 78730  
(512) 794-0100 • (800) 433-3488

Circle 283 on Inquiry Card.

EARN YOUR COLLEGE DEGREE AT HOME

## B.S. & M.S. In Computer Science

Get the opportunity and earning power a college degree confers—without leaving home and without spending thousands of dollars.

- Approved for tuition reimbursement by leading corporations
- ALL COURSES BY CORRESPONDENCE
- Most courses interactive
- Approved Ada course available
- Qualified instructors available on telephone help lines

Phone: 1-205-323-6191 • FAX: 1-205-328-2229  
2101 BYX Magnolia Ave. • Suite 200 • B'ham, AL 35205

AMERICAN  
INSTITUTE  
OF  
COMPUTER  
SCIENCES

*The leading edge of learning*

## ROMboy

Low Cost, Reliable, High  
Quality ROM Emulation on  
the Creators of PROMICE



- Emulation of up to 1 Mbit ROMs (4 Mbit - soon)
- Supports any ROM type (DIP or PLCC)
- Supports high speed ROMs
- Supports any word size up to 2048 bits wide
- Host software for DOS, Unix, Mac, VMS
- Battery backed memory
- Intelligent micro-controller based unit
- SMT CMOS layout for robustness
- Tiny size: 2.5" x 3.8" x 0.9"
- Unbelievably low price! \$295

ROMboy...

from the authority in firmware development tools

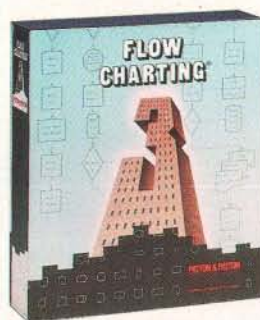
Orders: (614)899-7878  
West: (415)750-0219  
FAX: (614)899-7888



Grammar  
Engine  
Inc.

Circle 307 on Inquiry Card.

## FLOW CHARTING 3



Powerful new features – for greater speed, flexibility, and ease-of-use!

- Single-page, multi-page or canvas charts – portrait or landscape
- Custom fonts support high resolution laser and 24-pin dot matrix printers
- 35 standard shapes, 10 text fonts
- Suggested retail price: only \$250

See your dealer today! or,  
for a "live" interactive demo disk,  
call: 800-525-0082, ext 1218  
International: 408-778-6557, ext 1218  
fax: 408-778-9972

**PATTON & PATTON**  
Software Corporation

Circle 285 on Inquiry Card.

Let your  
"true colors shine through"  
when you advertise your  
computer products in BYTE's  
**HARDWARE/SOFTWARE SHOWCASE**

our newest, affordable,  
4-color advertising section!

Call for more details:  
(603) 924-2695 or (603) 924-2598

1-800-753-7877

**SURPLUS**  
SOFTWARE  
INTERNATIONAL

Only \$59

- NORTON UTILITIES 6.0
- Recovers Your Valuable Data!
- Guards Your Data!
- Speeds Up Your Hard Disk!
- The Ultimate DOS Enhancer!
- Windows 3.1 Compatible!

Only \$59

- AUTODESK ANIMATOR
- Animate Brilliant Color Graphics, Text & Photos Into Presentations!
- One Simple, Intuitive Interface!
- Five Types of Animation!
- Includes Animation Video!

Only \$29

- MS MONEY FOR WINDOWS
- Personal & Business Expense Tracking For Cash, Checking & Credit Cards!
- Quicken Compatibility!

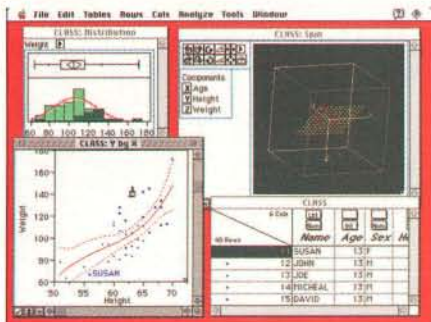


Circle 322 on Inquiry Card.



# Make this your "leap" year with JMP® Statistical Discovery Software

"JMP is a leap forward in its overall approach. It combines graphics and statistics on a workstation better than any other existing product...The ease of use, low cost, and the context sensitive help system may do for statistics what spreadsheet software has done for accounting."



Interface/Computing and Telecommunications  
Services News—Univ. of California, Santa Cruz

Call today for a free demo disk and Points  
of Interest from the leading name in data  
analysis software...SAS Institute Inc.  
919-677-8000. Fax 919-677-8166.

JMP is a registered trademark of SAS Institute Inc.  
Copyright © 1992



Circle 289 on Inquiry Card.

# RS-232++

NEW!

## Greenleaf Comm++™ Asynchronous Comm Class Library

- C++ class library for DOS, Windows 3.x and OS/2.
- Device independence through inheritance.
- Supports Zortech, Microsoft 7.0, JPI and Borland C++.
- IBM PC, XT, AT, PS/2 and compatibles.
- COM1..COM8, and DigiBoard.
- Baud rates to 115,200.
- XON/XOFF, RTS/CTS flow controls.
- XMODEM, Kermit file transfer protocols.
- VT52, VT100 subset, ANSI & TTY terminal emulation.
- Hayes modem control classes.
- Line and link level controls & status.
- Extensive examples help you get started with OOP applications using communications.
- FREE Source Code
- FREE Unlimited Support
- No Royalties
- Money-Back Guarantee
- Top Rated Documentation



CALL (800)523-9830 NOW!

Fax (214) 248-7830

Circle 271 on Inquiry Card.

# APL

Complete APL system \$60. PC, 386, WINDOWS.

# J

Ken's new APL for teaching and research. Uses ASCII.  
Shareware and documentation \$24. Source \$90.

## Iverson Software Inc.

33 Major St., Toronto, Ontario, Canada M5S 2K9  
Phone (416) 925-6096 Fax (416) 488-7559

Circle 311 on Inquiry Card.

## Cross Assemblers, Simulators, Disassemblers



Processor Families:

8051	8096	8048
Z80	64180	6301
6805	6800	1802
6811	6502	68k
8085	6801	Z8

Join Thousands of Satisfied  
Customers Worldwide.

Call:

## PseudoCorp

716 Thimble Shoals Blvd., Newport News, VA 23606  
Tel: (804) 873-1947 • Fax: (804) 873-2154

Circle 287 on Inquiry Card.

# CODE RUNNER

"Makes your C TSRs  
smaller than you  
could imagine."

Mark Davidson, Computer Language

CodeRunner® The #1 TSR Library for C and ASM

- 300+ functions in highly optimized assembler
- Auto-Disposal of initialization code and data
- Hotkeys, schedulers, fast background COMs
- Safe DOS use from TSRs, Network Friendly
- Online hypertext help, Quick start templates
- Swap apps or graphics to EMS/XMS, spawn ...

## Pick of the Professionals

"cream of the crop"

Tom Swan, PC World

"highly useful"

R. Bradley Andrews, DDJ

"not only solves problems, it inspires new possibilities.  
It is destined for the programmer's Hall of Fame"

Joe Campbell, Author C Programmer's Guide to Serial Communications

"the size of any program you create with CodeRunner  
will astound you"

Mark Davidson, Computer Language

"excels in its TSR capabilities, coexistence with  
other DOS applications and support"

Victor R. Volkman, The C Users Journal

"professional development tool that'll let you create  
compact, fast TSRs"

Gary Entsminger, Micro Cornucopia



Omega Point, Inc.  
25 Birch Rd., Framingham, MA 01701  
508 877-1819 FAX: 508 877-0915

Circle 313 on Inquiry Card.



## Setting The Standard in Graphical Menuing Systems!



### QuikMenu™ III

Demo Disk Available  
OEM & Dealer Inquiries Welcome  
References Available

Features: Free Form Screen Layout, Choice of Fonts & Colors, Automatic Installation, File Manager, Icon Editor, Calculator, Calendar, Phone Dialer, Usage Tracking, Password Protection, User Prompting, NOT Memory Resident, PCX Background (req. EMS), Network Compatible, Supports CGA/EGA/VGA/Hercules, Does NOT Require Windows!



OSCS  
Software  
Development  
Inc.

**\$89.95\***  
30 day money back guarantee!  
**1-800-545-1392**

\*Please add \$5.00 shipping & handling



354 NE GREENWOOD AVENUE, SUITE 108 ▲ BEND, OREGON 97701  
VOICE: (503) 389-5489 ▲ FAX: (503) 388-8221 ▲ BBS: (503) 383-7195

Circle 300 on Inquiry Card.

## Breaking The Foreign Language Barriers!



### Globalink Translation Software...

incredibly accurate  
foreign language translations  
at record speeds.

• Works with Word Perfect! •

Up to 100 times faster than human translators, with an accuracy rate often exceeding 90%, **Globalink Translation Software (GTS)** makes quick work of foreign language translations. Sentence by sentence — not word by word — in correct grammatical structure, **GTS** translates entire documents to and from English and **Russian, German, French, Spanish**. From only \$495, **GTS** is on the job in thousands of companies worldwide. Call Globalink now. And break through your own foreign language barriers!

See your software dealer or call Globalink today!

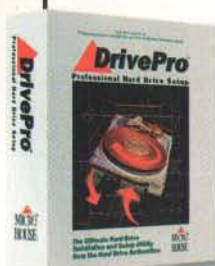


**1-800-255-5660**

(1-703-273-5600 Outside The U.S.)

Circle 269 on Inquiry Card.

## Dive Deeper Into Your Hard Drive than ever before



**No more DEBUG** - Finds & executes controller's on-board firmware.

**No more FDISK** - Full featured partition table creator and editor.

**No more SETUP** - View and edit BIOS drive type table, set CMOS.

**No more FORMAT** - DOS format with operating system transfer.

**No more BIOS DRIVE TABLE LIMITATIONS**  
Custom drive types for any bios.

For Complete Information: **1-800-926-8299**

Limited Time Offer  
**\$99.95**

**DrivePro™**  
Professional Hard Drive Setup  
FAX 303-443-3323  
BBS 303-443-9957



Circle 305 on Inquiry Card.

Call 1-800-793-7356

For your multimedia  
sound editing needs  
Only \$99



Requires Windows 3.1 and compatible sound board

Order the full-working demo with a CD of nearly  
100 professional sound clips from Hollywood Edge for only \$5.  
Digital Soup, Inc. • PO Box 1340 • Brattleboro • Vermont 05302

Circle 325 on Inquiry Card.

## BYTE

### Breaks the 4-Color Price Barrier with the Hardware/Software Showcase

See how affordable it is to advertise  
to BYTE's 500,000 computer  
professionals in this section!

Call for more advertising  
information:

**(603) 924-2695**

**or (603) 924-2598**



# THE BUYER'S MART

## A DIRECTORY OF PRODUCTS AND SERVICES

THE BUYER'S MART is a monthly advertising section which enables readers to locate suppliers by product category. As a unique feature, each BUYER'S MART ad includes an Inquiry number to assist interested readers in requesting information from participating advertisers.

Effective January 1, 1992.

RATES: 3 issues—\$625 6 issues—\$600 12 issues—\$525 13 issues—\$500  
 Repayment must accompany each insertion. VISA/MC Accepted.

AD FORMAT: Each ad will be designed and typeset by BYTE. Advertisers must

furnish typewritten copy. Ads can include headline (23 characters maximum), descriptive text (250 characters is recommended, but up to 350 characters can be accommodated) plus company name, address and telephone number. Do not send logos or camera-ready artwork.

DEADLINE: Ad copy is due approximately 2 months prior to issue date. For example: November issue closes on September 8. Send your copy and payment to THE BUYER'S MART, BYTEMagazine, 1 Phoenix Mill Lane, Peterborough, NH 03458. For more information call Margot Gnade at 603-924-2656. FAX: 603-924-2683.

### ACADEMIC COMPUTING

#### LEARN PARALLEL PROCESSING Transputer Education Kit \$396

Kit includes ready-to-use PC add-in board with T400 transputer, 1MB of RAM, and PC interface. Complete with Occam2 and C compilers, assembler, source-level debuggers, example programs and 1500 pages of documentation (incl. schematics). Expandable!

#### Computer System Architects

100 Liberty Plaza, 15 North 100 East, Provo UT 84606-3100  
 (800) 753-4CSA (801) 374-2300 FAX (801) 374-2306

Inquiry 701.

### ACCESSORIES

#### RADIOACTIVE?

Plot it on your PC with The RM-60 RADIATION MONITOR. Serial or printer port. Detects: ALPHA • BETA • GAMMA • X-RAY. MicroR, 1000 times the resolution of standard geiger counters. Excellent for tracking RADON GAS. Find sources. New: Version 2.9 • WINDOWS, Plot: • Background • Cosmic Rays • Clouds • Foods • Call/Write for PC MAGAZINE review. • TSR • GM Tube VISA/MC/EURO. Phone orders. Not satisfied? Full refund.

800-729-5397 or Tel/Fax: (302) 655-3800  
**Aware Electronics Corp.**  
 P.O. Box 4299, Wilmington, DE 19807 \$149.50

#### CUT RIBBON COSTS

Re-ink your printer ribbons quickly and easily. Do all cartridge ribbons with just one inker! For crisp, black professional print since 1982. You can choose from 3 models:

Manual E-Zee Inker—\$39.50  
 Electric E-Zee Inker—\$94.50  
 Ink Master (Electric)—\$189.00

1000s of satisfied users. Money-back guarantee.

#### BORG INDUSTRIES

525 MAIN ST., JANESVILLE, IA 50647  
 1-800-553-2404 In IA: 319-987-2976

Inquiry 702.

### KEYBOARD, VIDEO, MOUSE, AUDIO

Extend signals from PC with **EXTENDER**. Split signals with **COMPANION/PC EXPANDER**. Switch signals among PCs with **COMMANDER**. Boosts signals up to 600 feet. Control up to 96 PCs with one keyboard, monitor and mouse.

#### CYBEX CORPORATION

2800H Bob Wallace Ave., Huntsville, AL 35805  
 Phone: 205-534-0011 Fax: 205-534-0010

Inquiry 703.

#### TAKING PC OVERSEAS? We've Got 220V/115V Converters All Wattages

Your Converter & Cable Connection Source!

Cables • Books • Computer Batteries

o. California's Largest "In-Stock" Computer Supplies & Parts Inventory

(800) 321-4524 (CA)

(800) 548-7135 (US/Can)

**ELECTRONICS PLUS inc.**

Inquiry 704.

### ACCESSORIES

#### CUSTOM KEYBOARDS AND TERMINALS Engineering, Development and Production

- Point-of-Sale • Special purpose • Harsh environment
- Access control • Data collection • Operator input
- Unique • Industrial • Any interface, key style or size
- No minimum quantity required

#### GENOVATION, Inc.

17741 Mitchell North, Irvine, CA 92714  
 (800) 822-4333 (714) 833-3355 FAX (714) 833-0322

Inquiry 705.

### ARTIFICIAL INTELLIGENCE

#### FUZZY LOGIC AND NEURAL NETWORK TRAINING AND DEVELOPMENT SYSTEMS

PC-based add-in cards with menu-driven software and instruction manual. Allows user to learn Fuzzy Logic and Neural Networks in addition to developing actual applications. Pricing from \$395.00

#### AMERICAN NEURALOGIX, INC.

411 Central Park Drive, Sanford, FL 32771  
 Phone: 407-322-5608 Fax: 407-322-5609

Inquiry 706.

### BAR CODE

#### LABELING SOFTWARE

On EPSON, IBM, OKI dot matrix or LaserJet. Flexible design on one easy screen. Any format/size. Up to 120 fields/label. 18 text sizes to 3"-readable at 100'. ALAG, MIL-STD, 2 of 5, 128, UPC/EAN, Code 39. File Input & Scanned logos/symbols (PCX)—\$279. Other programs from \$49. 30-day \$\$ back.

#### Worthington Data Solutions

417-A Ingalls St., Santa Cruz, CA 95060  
 (408) 458-9938 (800) 345-4220

#### BAR CODE READERS

For PC, XT, AT, & PS/2, Macintosh, and any RS-232 terminal. Acts like 2nd keyboard, bar codes read as keyed data. With steel wand—\$399. Top rated in independent reviews. Works with DOS, Xenix, Novell, Alloy, -ALL software. Lasers, magstripe, & slot badge readers. 30-day \$\$ back.

#### Worthington Data Solutions

417-A Ingalls St., Santa Cruz, CA 95060  
 (408) 458-9938 (800) 345-4220

#### PORTABLE READER

Battery-operated, handheld reader with 64K static RAM, 2x16 LCD display, 32-key keyboard, Real-Time-Clock. Wand or laser scanner. Program prompts and data checking through its own keyboard. Easy data transfer by RS-232 port or PC, PS/2 keyboard. Doubles as On-Line Reader. 30-day \$\$ back.

#### Worthington Data Solutions

417-A Ingalls St., Santa Cruz, CA 95060  
 (408) 458-9938 (800) 345-4220

### BAR CODE

#### PRINT BAR CODES/BIG TEXT FROM YOUR PROGRAM

Add bar codes and big graphics characters to your program. Print from ANY MS-DOS language. Bar codes: UPC, EAN, 2 of 5, MSI, Code 39, Epson, Oki, IBM dot matrix text up to 1/2". LaserJet up to 2". Font cartridges not required. \$179-\$239. 30-day \$\$ back.

#### Worthington Data Solutions

417-A Ingalls St., Santa Cruz, CA 95060  
 (408) 458-9938 (800) 345-4220

#### BAR CODE READERS

Keyboard emulation for PC/XT/AT & PS/2s, all clones and any RS-232 Terminal. Transparent to your operating system. Available with Steel wands, Lasers, Slot & Magstripe Readers. Same day shipping. 30-day money-back guarantee. One-year warranty. Reseller discounts available.

#### AMERICAN MICROSYSTEMS

2190 A Regal Parkway, Eufless, TX 76040  
 (800) 648-4452 (817) 571-9015 FAX (817) 685-6232

#### BAR CODE PRINTING SOFTWARE

- MS/PC DOS SYSTEMS
- 9 & 24 PIN DOT MATRIX
- H-P LASER JET/PLUS/SERIES II
- MENU-DRIVEN or MEMORY RESIDENT
- CODE 39, 12/5, UPC A/E, EAN 8/13
- BIG TEXT & BAR CODE SOFTFOUNTS

#### AMERICAN MICROSYSTEMS

2190 A Regal Parkway, Eufless, TX 76040  
 (800) 648-4452 (817) 571-9015 FAX (817) 685-6232

#### PORTABLE BAR CODE READER

Battery operated, handheld reader with 64K RAM, 54 key keyboard, real-time clock, 2X16 LCD display, and built-in calculator. Supports WAND, CCD, and LASER. Built-in program generator supports multiple programs and data files. Interfaces to PC & PS/2 keyboards. RS-232 terminals, and HAYES compatible modems. 30-DAY MONEY-BACK GUARANTEE.

#### AMERICAN MICROSYSTEMS

2190 A Regal Parkway, Eufless, TX 76040  
 (800) 648-4452 (817) 571-9015 FAX (817) 685-6232

#### ULTIMATE BAR CODING

- KEYBOARD WEDGES for PC/AT/XT, PS/2 with wand, \$249. RS232 & IBM terminals, Mac, AT&T, NEC, Wang...
- PORTABLE readers 64K-256K, \$750
- HP wands/PC, SP lasers/CCDs/ mag stripe & badge slot
- Software to print & read bar codes
- P.O.S. - cash drawers/receipt printers...
- 30-day \$\$ back / 1 Year Warranty.
- Generous Dealer Discounts - Se Habla Español

#### BARCODE INTERNATIONAL SYSTEMS

9190 Palm Canyon Dr., Corona, CA 91719  
 (714) 277-1917 FAX: (714) 277-1005

Inquiry 707.



## BAR CODE

### PRINT & READ BAR CODES!

The Standard Edition of KNOW-WEDGE for CODE 39 Complete with Stainless Steel Wand. Includes FREE bar code printing software!

**ONLY \$159.00.**

For alternative hardware or software solutions

**CALL**

### COMPUTER RESOURCES GROUP

629 Silverdale Drive, Claremont, CA 91711  
VOICE: (714) 624-8734 BBS: (714) 626-1054

Inquiry 708.

### LAPTOP WAND & SOFTWARE: \$199 PC WAND & WEDGE: \$188

Both complete with STAINLESS STEEL WANDS, AUTOSELECT ALL POPULAR CODES and SOFTWARE-TRANSPARENT. LASERS from \$375, CCD scanners from \$245. PORTABLE & RF DATA COLLECTORS 8 line x 24 display. OPTICAL MARK (test form) readers. MAG STRIPE readers/writers. Slot (badge) readers. Bar code PRINTING SOFTWARE. Reseller discounts. 30-day money back.

### DATA HUNTER

6181 Medford, Huntington Beach, CA 92647  
(714) 892-5461 Fax 714-892-9768

### I. T. S. Bar Code Solutions

Bar codes are easy using our FULL line of readers & printers. They plug and play with your existing CPU/printer/terminals/ software systems in your office, store, truck, factory or warehouse. ITS' bar code DOS programs print on matrix or laser printers. 30 day refund. 1 year warranty. OEM/VAR/ Dealer discounts.

### International Technologies & Systems Corp.

655-K North Berry St., Brea, CA 92621 - Western USA  
13 Welwyn Court, Richmond, VA 23229 - Eastern USA  
(800) 228-9487 (714) 990-1880 (804) 741-6725 (FAX) 990-2503

Inquiry 709.

### PC BAR CODE SPECIALISTS

Bar code readers designed for fast, reliable, cost-effective data entry. They emulate your keyboard, so data looks just like it was typed in! Choose from stainless steel wand, laser gun, card slot or magnetic stripe scanners. Also, powerful label printing software. Great warranty. Generous reseller discounts. 30-DAY MONEY-BACK GUARANTEE.

### Seagull Scientific Systems

15127 N.E. 24th, Suite 333, Redmond, WA 98052  
1-800-758-2001 206-451-8966

### DATA INPUT DEVICES

Bar Code, Magnetic Stripe Readers & SmartCard Encoder/Reader for microcomputers & terminals, including IBM PS/2 & others, DEC, Macintosh, AT&T, CT, Wyse, Wang. All readers connect on the keyboard cable & are transparent to all software. UPC & 39 print programs, magnetic encoders, & portable readers are also available.

### TPS Electronics

4047 Transport, Palo Alto, CA 94303  
415-856-6833 Telex 371-9097 TPS PLA  
1-800-526-5920 FAX: 415-856-3843

Inquiry 710.

### VARIANT MICROSYSTEMS

### BAR CODE READERS DELIVER

WAND/LASER/MAGNETIC CARD CONNECTIVITY

- Keyboard wedges (Internal/External) for IBM PC/XT/AT, PS/2, and portables
- RS232C wedges for WYSE, Link, Kimtron terminals
- Bar code and label printing software
- Full two-year warranty
- 30-Day Money-Back Guarantee
- Extensive VAR/Dealer Discounts

46560 Fremont Blvd., Suite 206/Fremont, CA 94538/(510) 440-2870  
800-666-4BAR FAX: (415) 623-1372

Inquiry 711.

## BAR CODE

### LABEL SOFTWARE...\$299.95

WYSIWYG for HP, Epson and popular THERMAL/TTR. Bar code integration software for FoxPro, dBASE, CLIPPER.

### FOXPRO2 BAR CODE APPLICATIONS

Shop - Inventory - Tool - Warranty - Asset - Attendance

### WINTERCAMP TECHNOLOGIES

PO BOX 1875, Ramona CA 92065  
(619) 788-9660 FAX (619) 788-9690

Inquiry 712.

## BASIC LANGUAGE TOOLS

### BASIC Pop-Ups

Want to add text-based mouse integration, pull-down menus, pop-up windows, scroll bars and much more to your Quick-Basic Programs? Then order the IB Library NOW. Only US\$40. Includes library, demo program with source and documentation. Easy and quick to use. Dual Media.

### UHLIK Software

GPO Box 1842, Hobart Tas 7001, Australia

Inquiry 713.

## BOOKS

### Here is your QUE

to great savings on new computer books

- Newest releases
  - Fast UPS delivery
  - All major publishers
  - Free Catalog-on-a-Disk
- Ziff-Davis-McGraw Hill-Microsoft Press-Que-New Riders Press  
SAMS-Brady-Syber-Addison Wesley-Ventura  
Peach Pit Press - Bantam - Wiley - Van Nostrand - W.H. Freeman  
• Discounts: 1 Book 25% OFF 3+ Books 30% OFF

Visa, MasterCard and Discover Card Accepted

### README.DOC COMPUTER BOOKS

211 N. Second Street, Chambersburg, PA 17201  
(800) 678-1473 Fax: (717) 264-6614

Inquiry 714.

## CAD

### at last...TOOLS FOR PCB DESIGN FOR OrCad PCB II

- Automatic Gerber tool file merge
- Automated netlist to Gerber file Power/Ground plane generation
- Automated aperture tool file generation for Gerber viewers: View+, PCGerber

### SAVE TIME • ELIMINATE ERRORS

Price: \$95 plus Postage & handling. Send your check to:

### A. SHAR Technical Services

55 Catherine Street, St. Ives N.S.W. 2075, Australia  
Tel/Fax (061/2) 449 5625  
OrCad PCB is a trademark of OrCad Systems. View+ is a trademark of Laverin Technology. PCGerber is a trademark of Cad Solutions.

Inquiry 715.

### Draws Air Conditioning Duct Parametrically Inside AutoCAD 3D Package \$325 2D Package \$125

- Round, Rectangular, Flex Duct
- Reducers, Spinins, Extractors
- Radius, Rounded, Mitered Corners
- Rises, Drops, Transitions, Tees
- Duct Editor, Pop-Down Menu

### MC SQUARED CAD SUPPORT GROUP

(512) 824-4106 Fax: (512) 824-4633

Inquiry 716.

### PCB & SCHEMATIC CAD-\$195

"EASY-PC" for single-sided and multilayer boards to 17"x17" with up to 1500 ICs including surface mount. Phenomenally fast and easy to use. Over 13,000 copies sold. Needs PC/XT/286/386 HERC/CGA/EGA/VGA. Output to laserjet/inkjet/dot matrix printer, pen-plotter, photo-plotter and NC Drill. Not copy protected. VISA/MC/MEX welcome. For full info circle inquiry # or contact us directly.

### NUMBER ONE SYSTEMS LTD.

Harding Way, St. Ives, Huntingdon, Cambs, England, PE17 4WR  
Tel: 011-44-480-61778 Fax: 011-44-480-494042

Inquiry 717.

## CAD

### Sirlin's CAD ++ ENGINE

- Read and Write AutoCAD DWG and DXF files.
- Object oriented, modular, database-like access to CAD data.
- View, Print (rasterize), Plot (vectorize), and Pick (interact) modules.
- Available for C/C++ for DOS, Extended DOS, Windows, Sun and other Unix systems.

### Sirlin Computer Corporation

25 Orchard View Dr., Ste 14, Londonderry, NH 03053  
Phone: (603) 437-0727 • Fax: (603) 437-0737

Inquiry 718.

### AutoCAD Users

### Increase your productivity with AutoMate/PRO™

graphical display list software for rel. 10, 11, 12 & AEW

- Icon menus • movable bird's eye view • real-time anti-aliasing • magnifying glass • real-time pan & zoom • Quick Menu • enhanced shading • supports Super VGA, XGA, TGA and more at any resolution. Windows version available

**Only \$295 Money-back guarantee**

### Call Vermont Microsystems

1-800-354-0055 1-802-655-2860

Inquiry 719.

## CAD/CAM

### CONTOURING MOTION CONTROL

### FROM A PRINTER PORT!

Indexer LPT™ software **\$249**

**NEW VERSION 3 VISA/MC**

- Controls up to six step motors simultaneously.
- Linear and Circular Interpolation.
- New features to accommodate machine control.
- Easy-to-use DOS device driver. Super Manual.
- CAD-CAM interface available.

Corporation, 1422 Arnold Ave.

Roslyn, PA 19001 (215) 657-4338  
FAX: (215) 657-7815

Inquiry 720.

### Desktop Prototyping Printed Circuit Boards

Now, with our kit and a desktop plotter, you can make single and double sided printed circuit boards IN MINUTES. Fine pitch lines with throughpad routing plotted directly on rigid board! Our product includes a complete tutorial package with demonstration CAD files on disk. For more information on kit, plotters, and/or accessories write:

### Tri State Technical

P.O. Box 350, Westbrookville, NY 12785  
Fax: 914-888-0531

Inquiry 721.

## CD-ROM

### High Performance Self Contained Portable CD-ROM Computing

Uncompromising Portable CD-ROM Computer Systems

4-64 MB RAM / 120-540MB HDD / Internal CD-ROM

FCC Class B Certified

386DX-33 -- \$3495 / 486DX-33 -- \$3995

### ACCESS INFORMATION INC.

The information retrieval experts

1-800-847-3830

Inquiry 722.

### CD-ROM DRIVE & 10 FREE DISCS

### High Performance CD-ROM drive:

DOS/MPC: Encyclopedia, Atlas, Mammals, Shareware, Danger Hot Stuff, Games II, Wild Places, World View, Crossword Cracker, Demonstration Disc. \$499.00 (Plus Freight)

Free Catalog (Overseas send \$5.00)

Hundreds of discs and optical products.

### CD ROM, Inc.

1667 Cole Blvd., #400, Golden, CO 80401

Orders: 800-821-5245

Questions: 303-231-9373 Fax: 303-231-9581

Inquiry 723.



## CD-ROM

\* Simtel MSDOS CD-ROM: Find what you need, when you need it. 550+ meg in 8300 files have the best utilities, applications, editors, programming tools, source code, etc. Thoroughly indexed, BBS ready. Produced June 92. \$24.95

\* Unix/MSDOS Source CD-ROM: Stop reinventing the wheel. 600+ meg of source code, internet comp. sources, \*. Simtel Unix-C, lots of MSDOS source. Thousands of complete working programs in C, asm, Pascal, etc. March 1992. \$39.95

\* ISO9660, fully guaranteed. Visa/MC/COD \$45 & \$10 air overseas.

### WALNUT CREEK CDROM

1547 Palos Verdes Suite 260 Walnut Creek CA 94596  
1 800 786 9907 +1 500 947 5996 +1 500 947 1644 (fax)

Inquiry 724.

## COMMUNICATIONS

### 3780 • BSC • RJE

- UNIX, OS/2, MS-DOS, and Windows
- Single and Multi-channel options
- Script, API, & Menu-Driven Interfaces
- Unattended and Interactive sessions
- Ideal for VARs, OEMs, and end-users!

**Serengeti Systems Incorporated**  
Call (800) 634-3122 or FAX (512) 480-8729

### X.25, HDLC, SDLC, BSC

SDLA card and software provides 'plug-in' synchronous link support for PCs which is inexpensive, easy to use and robust. Coprocessor architecture ensures reliable communications under any operating system at line speeds to 180kbps. Packages include protocol analyser, test and development software. OEM enquiries welcome.

Full function SNA emulation packages also available.  
**Sangoma Technologies Inc.**  
(416) 474-1990 1-800-388-2475

Inquiry 725.

## COMPUTER BOOKS

### COMPUTER BOOKS at a discount

15% discount. Latest books, 35 publishers.  
Free catalog. UPS & international shipping.  
Personal service. MC/Visa.

CompuServe 70007.1333. GO CBK  
From Internet: 70007.1333@compuserve.com  
Windows, C++, O/S 2.0, UNIX, Mac, OOP

### CompuBooks

Rt. 1, Box 271-D, Cedar Creek, TX 78612 USA  
800-880-6818, 512-321-9652 voice & FAX

Inquiry 726.

## COMPUTER INSURANCE

### INSURES YOUR COMPUTER

SAFEWARE Computerowner's coverage provides replacement of hardware, media and purchased software. As little as \$49 a year covers accidents, theft, power surges and more. One call does it all.

**TOLL FREE 1-800-848-3469**

**SAFEWARE, The Insurance Agency Inc.**

PO Box 02211, 2929 N. High St., Columbus, OH 43202

Inquiry 727.

## COMPUTER SYSTEMS

### LOW-LOW-LOW

Computer Systems/Notebooks/Network Solutions  
IBM-Apple-Compaq-AST-ALR-Everex & others  
SURAH 386/486 ISA/EISA-AMI/Mylex Motherboards  
CD ROMS • Tape Backup • Pocket FAX Modem LAN  
Cards • Hard Drives/Floppy Drives • Memory/upgrades  
• DRAMS, SIMM Modules • Laser Printers/Scanners  
• Plotters & Digitizers • Software

44912 Osgood Road, Fremont CA 94539 USA  
Phone: (510) 651-5101 Fax: (510) 651-5241

**SURAH inc.**  
**1-800-543-1001 Nationwide Orders**

Inquiry 728.

## COPROCESSORS

### MATH ACCELERATOR - \$25

Near-coprocessor performance from software!  
• Up to 6X faster spreadsheets, graphics, CAD, fonts generation, etc. • DOS, Windows, EMM, & DOS Extenders compatible. • Uses NO DOS memory! • For 386SX and higher processors. • Full coprocessor emulation, application transparent.

Get Q387 Ver. 3.0 from CompuServe (IBM hardware forum), America OnLine, Genie, Delphi, etc., or call:

**QuickWare**  
(512) 280-1452

Inquiry 729.

## CROSS ASSEMBLERS

### CROSS ASSEMBLERS

Fast, reliable with unlimited length of source code. Conditional assembly, complete set of arithmetic and logical operators. Optional listing with sorted Cross-reference Table. Price \$100.00 each.

**SIMULATOR-DEBUGGERS/DISASSEMBLERS**  
We offer excellent full-function simulators with built-in disassemblers for the 8048/49, 8051/52, 8080/85, and Z80 controllers, and now for the 8096 and 80C196, with their unique features fully supported. Prices from \$200 to \$300 each, with \$50.00 discounts for XASM + SIM packages.

### Lear Com Company

2440 Kipling St., Ste. 206, Lakewood CO 80215  
(303) 232-2226 FAX (303) 232-8721

Inquiry 730.

## CROSS DISASSEMBLERS

### PROFESSIONAL DEVELOPMENT SOFTWARE ASSEMBLERS/DISASSEMBLERS

8051, 8048, 8096, 8080/85, Z80/180  
Z8000, SPARC, 6800, 6809, 68HC11, 680X0,  
6502/C02, 6301, 9900

COMPLETE, OPTIMIZED DEVELOPMENT TOOL SETS  
FOR THE ENGINEERING PROFESSIONAL

CALL (408) 773-8465

### LOGISOFT

PO BOX 61929, SUNNYVALE CA 94086  
FAX: (408) 773-8466

Inquiry 731.

## DATA RECOVERY

### Ontrack DATA RECOVERY

- Unsurpassed success rate • Fast turn around
- Priority service available • Clean room
- Expertise in DOS, OS/2, Novell, Macintosh, Unix, Xenix, Sun, DEC, Wang, Banyan Vines and more!

MM:1-800-872-2599 • CA: 1-800-752-7557

6321 Bury Drive, Eden Prairie MN 55346  
2400 Main Street, Suite 200, Irvine CA 92714

Inquiry 732.

### Now we're ONTRACK in London Too.

ONTRACK DATA RECOVERY  
EUROPE, LTD.

Surrey House, 34 Eden St., Kingston upon Thames, Surrey KT1 1ER U.K.  
0800-24-39-96 • 44-81-974 5522

Inquiry 733.

## DATA/DISK CONVERSION

### CONVERTING YOUR DISKETTES? ENTRUST THEM TO US!

2500 Word Processor & Computer formats,  
3 1/2", 5 1/4", 8" Disks, Mag Tapes, Mag Cards, Cartridges,  
Cassettes & 8 MM Custom Conversions, Programming  
& Applications Development

### DISK DUPLICATION

### OCR SCANNING SERVICES

Call us for Quality, Best Prices and Quickest Turnaround Time.

**COMPANY COMPENDIA, INC.**, 55 E. Washington St., #237  
Chicago, IL 60602 TEL: 1-800-374-DISK FAX: 312-419-1390

Inquiry 734.

## DATA/DISK CONVERSION

### THE #1 CHOICE in disk & tape conversion

for many leading corporations, government agencies, law firms, and companies in every industry-world-wide.

Free test • Satisfaction guaranteed

### Graphics Unlimited Inc.

3000 Second St. North, Minneapolis, MN 55411  
(612) 588-7571 FAX: (612) 588-8783  
1-800-745-7571

Inquiry 735.

### IBM PC TO HP FILE COPY FASTER EASIER TO USE

Update version uses windows: Call for free demo! IBM PC <to> HP File Copy allows IBM PCs, PS/2, compatibles to interchange files with Hewlett-Packard Series 70, 80, 200, 300, 1000, 9000s.

### Oswego Software

Box 310 708/554-3567  
Oswego, IL 60543 FAX 708/554-3573

Inquiry 736.

## CONVERSION SERVICES

Convert any 9-track magnetic tape to or from over 3000 formats including 3 1/2", 5 1/4", 8" disk formats & word processors. Disk-to-disk conversions also available. Call for more info. Introducing OCR Scanning Services.

### Pivar Computing Services, Inc.

165 Arlington Hgts. Rd., Dept. #B  
Buffalo Grove, IL 60089 (800) Convert

## DATABASE

### Application Development for dBASE III Plus dBREADY™ Limited time offer only \$79 NO PROGRAMMING REQUIRED.

Complicated dBASE III Plus/Clipper applications developments which take weeks/months are completed within hours including multiple databases/relations, unlimited queries and fixed/custom reports, user friendly screens and menu-driven steps. Modifications/additions made easily. Actual price \$379. SATISFACTION GUARANTEED.

**Absolute Computer Services, Inc.**  
5033 Lincoln Oaks Dr. S., Ste. 1203, Fort Worth, TX 76132  
(817) 370-8385

Inquiry 738.

## DEBUGGING TOOL

### INTRCPT 256<sup>3</sup> Break Points

- Find Undocumented Functions
- Reverse Engineer
- Real-Time Debug and Disassemble
- Call, Trap, Monitor, and Log Interrupts
- DOS 5.0 and Windows Enhanced Mode

**\$99.00**  
(800) 325-4225

### HACKENSACK

P.O. Box 181386  
Arlington, TX 76096

## DIAGNOSTIC

### "..PINPOINT ANY PC FAILURE."

John C. Dvorak, PC Magazine 7/30/92

Top-rated PocketPOST Power On Self-Test card with diagnostic software for ISA/EISA/Micro-Channel. 180-page book. Hones your trouble shooting skills. CALL NOW.

### DATA DEPOT, Inc.

1710 Drew Street #5, Clearwater, FL 34615

**1-800-275-1913**

813-446-3402 FAX 813-443-4377

Inquiry 739.



## EDUCATION

### B.S. & M.S. In COMPUTER SCIENCE

The American Institute for Computer Sciences offers an in-depth correspondence program to earn your Bachelor of Science and Master of Science degrees in Computer Science at home. B.S. subjects covered are: MS/DOS, BASIC, PASCAL, C, Data File Processing, Data Structures & Operating systems. M.S. program includes subjects in Software Engineering and Artificial Intelligence.

### AMERICAN INST. for COMPUTER SCIENCES

2101-BY Magnolia Ave. South, Ste. 200, Birmingham, AL 35205

800-767-2427 205-323-6191

## ENTERTAINMENT

### 53 EGA/VGA GAMES

Buy this super collection of best-selling games for only \$9.95, including shipping and handling. (Please add \$5.00 for foreign orders.) Credit Cards Only.

### SMC SOFTWARE PUBLISHERS

(619) 931-8111 ext. 511

Inquiry 741.

### Go, NEMESIS, Go

Go - a Zen game. So appealing, it has endured 4,000 years. So useful governments study it.

NEMESIS Go Junior entices novices of any age.

NEMESIS Go Master Deluxe satiates the addicted.

Windows, Macintosh and DOS versions available.

Chaos Manor User's Choice Award (BYTE/1990)

### Toyogo, Inc. (800) 869-6469

PO Box 25460-Y, Honolulu, HI 96825-0460

(808) 396-5526 fax: (808) 396-4126

Inquiry 742.

## FILE MANAGEMENT

### Disk Cataloging System

wkDIR puts your disk file system data into a spreadsheet for analysis. For disk management, PC auditing, backup, security. Compatible with all spreadsheets. Handles deleted and hidden files. Saves time and disk space. \$69 + \$6 S&H. 30 day money-back guarantee.

### E Soft

1840 Oak Avenue 800-835-2246 ext. 23

Evanston, Illinois 60201 708-467-2203

Inquiry 743.

## FINANCIAL SOFTWARE

### BrainMaker:

"The most fascinating computer software I've ever seen...learn about this stuff." John Dvorak, PC Mag. Predicts stocks, bonds, sales, inventories. Comprehensive manual. Menus. 12,000 sold. PC or Mac.

Still only \$195!

Free Flyer: 800/284-8112, 916/477-7481

California Scientific Software

Inquiry 744.

## FLOW CHARTS

### New! - ADS Diagrammer 2.0

Why buy just a flow chart when you can have the power of a Windows™ technical illustration tool?

Call for your free trial disk today!

800-745-6095

### \$199 - Atlantic Design Systems

77 Sprucewood Dr., Gifford, NH 03246

Phone: (603) 524-2943 Fax: (603) 524-3657

Inquiry 745.

## FLOW CHARTS

### WINDOWS FLOWCHARTER \$129

RFFlow 2.0 is a professional drawing tool for flowcharts & org. charts. Requires Microsoft Windows. 100 shapes auto adjust in size. Diagonal lines and curves. Auto line routing and re-routing. Click on a shape to bring up a sub-chart. Move charts to other apps. via the Clipboard. Call for free trial disk.

### RFF ELECTRONICS

1053 Banyan Court, Loveland, CO 80538

Phone: (303) 663-5767 FAX: (303) 669-4889

## G.I.S.

### Digital Quad Maps

Local Street Maps, State Maps, and World Maps in DXF, PCX, PICT, PIC or TIF Formats. Gigabytes of Map data available

### Micro Map & CAD™

(303) 988-4940

Inquiry 746.

## HARD DRIVE REPAIR

### Pre-Owned Electronics, Inc™

THE Independent Provider, serving the Dealer, Professional, Corporate, Government, and Educational Buyer since 1985

### APPLE II® & MACINTOSH®

SYSTEMS • PARTS • EXCHANGE REPAIRS

Call for a Catalog... 800-274-5343

INT'L: 617-275-4600 • FAX: 617-275-4848

205 BURLINGTON ROAD • BEDFORD, MA 01730

Inquiry 747.

## HARDWARE

### Voice Mail/Fax/Modem/Multi Media 4-in-1

Fax/Modem w/MNP/V.42

Upgradable 3486 w/POST LED

Affordable 486EISA/Slim-EISA

Andgate 714-468-3084 Fax: 714-468-3078

See us at COMDEX/Fall '92 Booth #R8721

Inquiry 748.

### READ.ME

STOP paying high prices for computer parts and accessories. Become a member of the

### ASCII Buyers Club™

Call 800-238-ASCII

NY: 516-935-1602 Write Fax: 516-935-5231

Write

ALCO Sec./Comm., Inc.

P.O. Box 7049, Hicksville, NY 11802 - USA

Chassis, Boards, Memory, Drives, Video, CDs...

Inquiry 749.

### HEWLETT PACKARD

Buy - Sell - Trade

LaserJet

DeskJet

RuggedWriter

Electrostatic Plotters

• Monochrome and Color

HP 9000 Workstations and Vectras also available.

T. E. Dasher & Associates

4117 Second Ave., S. Birmingham, AL 35222

Phone: (205) 591-4747 Fax: (205) 591-1108

(800) 638-4833

Inquiry 750.

## HARDWARE/COMPUTERS

### SC/FOX™ EMBEDDED COMPUTERS

PC Parallel Coprocessor Plug-in Boards: 15 MIPS avg 50 MIPS burst, using the SC32 32-bit CPU or the 16-bit Harris RTX 2000™.

VME Master/Slave System Controller SBC: 18 MIPS avg 70 MIPS burst, uses RTX 2000 cpu, SCSI, 2 ser, 1 ptr ports, to 640K bytes.

Stand-Alone Single Board Computers: 18 MIPS avg 60 MIPS burst, 3U or 100x100mm Eurocard-size using either SC32 or RTX 2000.

Ideal for embedded real-time control, data acquisition, robotics, and signal processing. OEM software development system included.

SILICON COMPOSERS INC (415) 322-8763

208 California Avenue, Palo Alto, CA 94306

Inquiry 751.

### EV8 - II

68030 and 68EC030

32 bit Microprocessor Trainer and Development System with 32 Bit User Bus, Upload, Download, Assembler and Disassembler Onboard. The EV8 - II uses the Serial Port of a Terminal or PC and is similar to 8 and 16 bit units featured in many popular books. Other 8, 16 and 32 bit systems are available.

### Phone URDA, Inc.

1-800-338-0517 or 412-683-8732

Inquiry 752.

## HARDWARE/CONTROLLERS

### INDUSTRIAL STRENGTH SINGLE BOARD COMPUTER

Professionally designed and built for tough Monitor & Control applications. Programming is a snap in either BASIC, ANSI C, Forth, or Z180 Assembler. Features include: 16 chan. Hi-Res A/D • 4 RS232C/485 serial ports • 6 Timer/Counters • 32 Digital I/O lines • Up to 512K Memory with EEPROM • Networking • Opt. 2 chan. D/A, Clock and PC Support • E-PAC 3000 G2 \$389.00 qty 1.

### EMAC INC.

618-529-4525 FAX 618-457-0110

P.O. Box 2042, Carbondale, IL 62902

Inquiry 753.

## INDUSTRIAL COMPUTING

### Portable, Rack-Mount Industrial Computers & Single Board Computers

Desert Microsystems offers ruggedized portable and rack-mount industrial computer systems. The PortaRack is 30 lbs., 8-slots, aircraft aluminum, 200 Watt power supply, and can be rack-mounted or carried. Rack-mount computers of 8, 10, 14, and 20-slots with passive backplane or motherboard design. Extended two-year warranty standard. All U.S. made.

### Desert Microsystems, Inc.

P.O. Box H, Moreno Valley, CA 92556

(800) 633-0448

Inquiry 754.

## LANS

### The \$25 Network

Try the 1st truly low-cost LAN

• Connect 2 or 3 PCs, XT's, AT's

• Uses serial ports and 5-wire cable

• Runs at 115K baud

• Runs in background, totally transparent

• Share any device, any file, any time

• Needs only 14K of RAM

Skeptical? We make believers!

### Information Modes

P.O. Drawer F, Denton, TX 76202

817-387-3339 Orders 800-628-7992

Inquiry 755.

## LAPTOP COMPUTERS

### USED COMPUTERS IBM, COMPAQ, & MAJOR BRANDS LARGE SELECTION

COMPUTERS from \$169 Monitors from \$49

CGA Color Monitors \$129 Color Printers \$249

TANDY NOTEBOOK Computer \$199

Also - IBM PCjr & Convertible ACCESSORIES & SERVICE •

MEMORY EXPANSIONS • PARTS • DRIVES • MONITORS • KEY-

BOARDS • CONTROLLERS & SOFTWARE HARD-TO-FIND ITEMS

FREE CATALOG

### COMPUTER RESET

P.O. Box 461782, Garland, TX 75046

Phone (214) 276-8072 BBS & FAX (214) 272-7920

Inquiry 756.



## LAPTOP PERIPHERALS

### LAPTOP PERIPHERALS

NEW LOW PRICES ON:

- Battery Powered Printers
- Portable Hard Drives
- Laptop Expansion Systems
- Backlights AND MORE!

Call for free catalog

**AXONIX CORPORATION**  
(800) 866-9797

quiry 757.

## MULTIMEDIA

### Distributor Wanted!!

By Philips Taiwan  
GIVE A SECOND LIFE TO THE PC!!

"Philips DTV-1000 card" + IBM compatible PC + VGA monitor  
= IDTV (Improved Definition TV)

The Philips DTV-1000 card can be connected with VCR, LD player, camcorder, or TV/CATV signal from antenna/cable, then easily convert the PC into a high quality television. Any prospective distributor is welcome to contact Philips Taiwan: Phone Number: 886 2 5097666 ext. 5236 (Taiwan) Fax Number : 886 2 5005968 (Taiwan)

quiry 758.

## NOTEBOOKS

SAVE! PALMTOPS \* NOTEBOOKS SAVE!

TOSHIBA • EVEREX • ZENITH • AT & T • TANDON  
AST • SHARP • BONDWELL • ALR • LIBREX  
PANASONIC • ALTIMA • LEADING EDGE  
PACKARD BELL • SAMSUNG • NEC • TI • COMPAQ

• We ALSO carry accessories and software •  
**Computer Options Unlimited**

12 Malden Lane, Bound Brook, NJ 08805

Advice?: 908-469-7959

or Notebooks: 1-800-424-Port For Sub-notebooks: 1-800-Palmtop  
6 days Worldwide Sales

quiry 759.

## PROGRAMMERS TOOLS

### BOOST YOUR VISUAL BASIC!

VBIMPRESS adds new print & display function: portrait/landscape, letter/US legal & Other print format, scroll bars and zoom effect (99\$)

• CBASE for DBASE's users. Adds 4 new controls: set relation to, browse, 2 display controls & more than 50 functions adapted from DBASE to VB. (From Appendix blank to Zap). (219\$)

MC/VISA accepted

**BEAULIEU**

MONTREAL, CANADA

tel (514) 278 96 77

Fax (514) 278 9676

**THE EASIEST WAY TO ADD  
A PULL DOWN MENU TO A  
CHARACTER BASED PROGRAM IS  
BY USING PLAIN DESIGN'S  
MENU SYSTEM**

Supports Mouse operations, Submenus, Accelerators, and menu hotkeys. Borland C, MSC, MIXC compilers. Full source code provided. Introductory offer price: \$39.95+\$4.00 shipping and handling. NJ residents add 6% tax.

**Plain Design Inc.**

51 Chesnut Ave., Suite 58, Ridgewood, NJ 07450

Tel (201) 670-3922

FAX (201) 251-9118

quiry 761.

### C and C++ DOCUMENTATION TOOLS

**C-CALL (\$69)** Graphic-tree of caller/called hierarchy.  
**C-CMT (\$69)** Generate, insert, update comment-blocks.  
**C-METRIC (\$59)** Path complexity, lines/stmts/comments.  
**C-LIST (\$69)** List, action-diagram, reformat programs.  
**C-REF (\$59)** Local/global/parameter cross-reference.  
**C-DOC (\$199)** All 5 as 1 DOS program, <=15,000 lines.  
**Professional (\$299)** <=150,000 lines, DOS, OS/2, Windows.

**SOFTWARE BLACKSMITHS INC.**

6064 St. Ives Way, Mississauga, ONT, Canada L5N-4M1

Voice/Fax: (416) 858-4466 Demos/BBS: (416) 858-1916

quiry 762.

## PROGRAMMERS TOOLS

**DON'T DEVELOP NETWORK APPLICATIONS**  
without **NPPC**, a powerful library sub-routine package that handles all the details of NetBIOS or IPX programming! **NPPC** supports high-level program communications at the message level for all server/client and peer-to-peer models. If you are using C or Assembler, **NPPC** allows you to write a single application that runs on BOTH IPX AND NetBIOS without any modifications. **NPPC** is compatible with any true NetBIOS emulator, therefore applications written with **NPPC** will work with most LANs in the marketplace. We offer a 30 day money back guarantee.

**NPPC for IPX or NetBIOS: \$195.00, with source: \$395.00**  
**SOFTWAREHOUSE CORPORATION**  
326 State Street, Los Altos, CA 94022  
(415) 949-0203 FAX: (415) 949-0208

Inquiry 763.

### Boost Your BASIC with ProBas!

- Adds 938 new commands to QB and PDS
- Written in assembly for speed
- Gives your programs a professional look
- Easy to use, money back guarantee
- Other add-ons for BASIC, C & Visual Basic avail.

FREE DEMO Disk AND BOOKLET

**TeraTech (800) 447-9120 x162**

Dept 162, Suite 360, 3 Choke Cherry Rd., Rockville, MD 20850

Int'l (301) 330-6764 Fax (301) 963-0436 BBS (301) 963-7478

Inquiry 764.

## REPAIR SERVICES

### ✦ VIDEOS ✦

- Laser printer maint/repair for the layman (2 hrs.) \$39.95
- Dot matrix printer maint/repair for the layman (30 min.) \$39.95
- Fax machine maint/repair for the layman (30 min.) \$39.95

**STOP UNNECESSARY SERVICE CALLS!**  
**SPECIAL! BUY 2, GET ONE FREE!**

All credit cards accepted. \$3.60 for S&H 1-800-537-0589

**Viejo Publications, Inc.**

4470-107 Sunset Blvd. Ste 600, Los Angeles, CA 90027

Inquiry 765.

## SALES/MARKETING TOOLS

### Sell More with SALES ALLY

Client & Prospect Management Database, Word Processor, & Notepad Autodialing, Reports, Alarms Invoicing, Sales Forecasting, Networks.

- PC Magazine Editors' Choice • PC Computing "Best Product" • Mobile Office Mag Annual Award

Call for FREE Information Packet.

**SCHERRER RESOURCES, INC.**

8100 Cherokee Street, Philadelphia, PA 19118

215-836-1830, \$395 (Visa/MC/Amex)

Inquiry 766.

## SECURITY

### FIGHT PIRACY!

★ EVERLOCK 3.0 ★

**SOFTWARE COPY PROTECTION**

New Option Board Safe-New Remote Registration

New CPU LOCK-CD ROM LOCK and more

★ EVERKEY HARDWARE LOCKS ★

**Az-Tech Software, Inc.**

Call for a 201 East Franklin, Richmond, MO 64085

FREE (816) 776-2700

Demo (800) 227-0644

FAX (816) 776-8398

Inquiry 767.

### THE ULTIMATE COPY PROTECTION

- Completely menu driven
- Defeats all Hardware/Software Copiers
- No Source Code Changes
- Multiple Layering
- No Damaged Media
- Full Hard Disk & LAN Support
- Unlimited Metering, FREE Demo Disk

STOPVIEW™ STOPCOPY PLUS™ (800) 879-2224

**BBi COMPUTER SYSTEMS, INC.** (301) 871-1094

14105 Heritage Lane, Silver Spring, MD 20906

FAX: (301) 460-7545

Inquiry 768.

## SECURITY

### Cop's CopyLock II

The professional software protection with TRUE Machine Install. Option Board safe. Supports OS/2, Windows and Trace.

### LINK Computer

Int'l: +45 31232350 Fax: +45 31238448

US/CAN: 800-344-2545 FAX: 408-923-7061

Inquiry 769.

### BIT-LOCK® SECURITY

Piracy SURVIVAL 10 YEARS proves effectiveness of powerful multilayered security. Rapid decryption algorithms. PARALLEL or SERIAL port-transparent security device. Complemented by economical KEY-LOCK™ and multifeatured COMPU-LOCK™ including countdown, timeout, data encryption, and multiproduct protection. (Dos/Unix/Mac). Also, access control.

### MICROCOMPUTER APPLICATIONS

3167 E. Otero Circle, Littleton, CO 80122

(303) 770-1917

Inquiry 770.

### CopyControl

Effective, Powerful, User Friendly Copy Protection

- Beats all bit copiers & dis-assemblers
- Compatible with all IBM MSDOS compatible computers
- No add on hardware or special diskettes required
- Supports networks, backups, disk caches, windows etc.
- Control where, when & how often your programs are run
- Remote changing of parameters

**ELIMINATE UNAUTHORISED COPIES NOW**

**Microcosm Limited**

17 Cranbrook Road, Redland, Bristol, B56 7BL, United Kingdom

Telephone (+44) 272 441230 Fax (+44) 272 427295

Call or write for information pack, demo available, distributors wanted

Inquiry 771.

## SHAREWARE

### THE AMISH OUTLAW

SHAREWARE COMPANY

★★★★★★★★★ FREE ★★★★★★★★★★

WITH EVERY ORDER YOU WILL RECEIVE A GREAT NEW GAME

NOT LISTED IN OUR CATALOG ABSOLUTELY FREE

ALL DISKS HAVE EASY-TO-USE MENUS

SIMPLY TYPE "GO" TO ACCESS PROGRAMS

\$3.00 PER DISK 1-9 - \$2.50 PER DISK 10-UP

3.5" AND 5.25" DISKS SAME PRICE

(IBM PUBLIC DOMAIN AND SHAREWARE ONLY)

3705 RICHMOND AVE., STATEN ISLAND, NY 10312

1-(800) 947-4346 or (718) 317-0198 FAX 1-(718) 966-4766

Inquiry 771.

### THE BEST FOR LESS!!

Latest shareware available at low, low prices on either floppies or CD ROMs. Check us first. Don't buy until you check price and quality.

Free catalog call (612) 934-4775 or write:

**ROCKET SHAREWARE**

P.O. Box 39326, Edina, Minnesota 55439

Inquiry 772.

## SOFTWARE/ACCOUNTING

### dBASE BUSINESS TOOLS

- GENERAL LEDGER
- PURCH ORD/INVENTORY
- ORDER ENTRY
- ACCOUNTS RECEIVABLE
- JOB COSTING
- JOB ESTIMATING
- BILL OF MATLS
- SALES ANALYSIS
- PAYROLL
- ACCOUNTS PAYABLE

\$99/\$198 ea. + S&H

**DATAMAR SYSTEMS** Cred. Card-Check-COD

8586 Miramar Place, San Diego, CA 92121

(619) 452-0044 (800) 223-9963

Inquiry 773.



## SOFTWARE/BUSINESS

### DATA ENTRY SOFTWARE

Full featured, heads-down data entry with two-pass verification, edit language, operator stats, much more! Designed for the PS/2<sup>®</sup>, PC, XT, AT or compatibles.

PCs from \$395 LAN version available  
**FREE 30 day trial**

Computer Keyes Tel: 206/776/6443  
21929 Makah Rd., Fax: 206/776-7210  
Woodway, WA 98020 USA: 800/356-0203

## SOFTWARE/DATA COMPRESSION

### Double your hard disk ZIPIT™

- Continuous floppy archive of huge files.
- Automatic creation of self-extract file.
- One-step imploding of directory trees.
- Transfer huge files between PCs.
- Shareware version available on BBSs.
- Send \$49. Visa/MC/Check/MO.

#### DIRTRAN SYSTEMS INC.

PO BOX 1207, ROSLYN PA 19001

Phone (800) 995-2501 Fax: (215) 659-2029

Inquiry 774.

## SOFTWARE/DOCUMENTATION

### Automated User Manuals Faster! Easier! Better!

- Interactive Structured System Cuts Documentation Time 50% to 80%
- Graphics, Fonts, Extensive Printing Options
- Manuals Include Table of Contents, Full Index, Getting Started, Reference, Tutorials and More!
- Just \$199.95! Call 1-800-221-8275 for Free Demo!

**DocMaker**  
Automated  
Documentation  
System

**Task Software Co.**  
2856 Falling Tree Circle  
Orlando, FL 32837  
407-826-0348

Inquiry 775.

## SOFTWARE/ENGINEERING

### Mixed Mode Simulation

- NEW IsSPICE 3 with Analog/Digital simulation
- Draws waveforms as the simulation runs
- PC and Macintosh Versions
- Filter Design
- Schematic Entry
- Extensive Model Libraries
- Waveform Analysis
- Full SPICE programs starting at \$95. Complete systems from \$990.

Call for your Free Demo and Information kit.

P.O. Box 710, San Pedro, CA 90733-0710  
310-833-0710, FAX: 310-833-9658

**intusoft**

Inquiry 776.

### GEOMETRY/TRIGONOMETRY CALCULATOR

**Apollonius** - Sketch-based geometry/ trigonometry solver. State-of-the-art variational geometry system lets you sketch your geometry or trig problem and automatically solves for distances, angles and areas. Integrated equation calculator, graphs and tables plus DDE and clipboard support. Ideal for surveyors, engineers, machine shops, students, architects, or anyone who uses trig. Runs under MS Windows 3.0 \$98

**Saltire Software 1-800-659-1874**

Inquiry 777.

### CAE SOFTWARE

- ECA-2: Analog Circuit Simulator • AC, DC, Transient Analysis • MonteCarlo, WCA • Interactive/full nonlinear
- SAUNA: 3-D Thermal Analysis • PC Bds, heat sinks, & enclosures • All HT modes • Thermal parameters library
- ACTIVE: Switched Cap & Active Filters • Order 1-50 of 5 cascaded filters • (45) topologies • (8) Types

For FREE demo call:

**Tatum Labs Inc.**

1287 North Silo Ridge Drive, Ann Arbor MI 48108  
(313) 663-8810

Inquiry 778.

## SOFTWARE/GRAPHICS

### TIFF, PCX, TARGA, GIF, DIB, BMP, WMF, WPG

#### AccuSoft Image Format Library

Import, export, convert, display and print images. DOS & Windows versions included in one low-priced, royalty-free package. Sample applications with complete source code. Compatible with all major C, C++ compilers and all Windows languages. Supports all formats of each format up to 24 bits/pixel. 30 day satisfaction guarantee. \$295

#### AccuSoft Corporation

160 E. Main St., Westboro, MA 01581  
(800) 525-3577 (508) 898-2770 FAX (508) 898-9662

Inquiry 779.

### Develop CAD/CAM, GIS, A/E/C Products

#### ON TIME and UNDER BUDGET with the "CAD/CAM Developer's Kit" Series

The CCDKs are libraries of C functions which support routines for DXF input/output, graphical display, line/arc/ellipse/NURB spline construction/editing, and much more than can be described here.

#### Building Block Software, Inc.

371 Moody Street, Waltham, MA 02154

Voice (617) 899-4350 Fax (617) 899-4399

Inquiry 780.

### "The Ultimate CAD/CAM/CAE Programming Engine"

Slash development time with TG-Professional v.4.0, the most complete C/C++ toolbox of 2D & 3D geometric routines available today! Over 800 routines including NURBS, DXF, Graphics, Surfacing, Hidden Line, Transforms, Perspectives, Polygon (Int/Union/Diff), Clipping, Tangents, Graphics routines for drawing using BGI or MSC Graphics and more. Full source. 30 day guarantee. USA \$500.00, Foreign \$565.00US. Use MSC, Borland C/C++, WATCOM C/C++ or Metaware High C/C++. Call 1-800-635-7760 or Fax/Phone 214-423-7288 for free technical information.

#### Disk Software Inc.

2116 E. Arapaho Rd., Suite 487, Richardson, TX USA 75081

Inquiry 781.

### RAINDROP™

FAST, compact PRTScrn Utility for end users AND developers. Hardcopy as fast as 10 secs. Average binary size - 6 kbyte. 14 video graphic standards. Scale, rotate, colorize and more. 'CALL' from user-written programs. Complete 9- & 24-pin dot-matrix, inkjet, and laserjet library \$44.95 + \$3 s/h.

#### ECLECTIC SYSTEMS

8106 St. David Ct., Springfield, VA 22153

(703) 440-0064 Fax (703) 455-8965

Inquiry 782.

## SOFTWARE/GUI

### GUI TOOLKIT ONLY \$249

Full source code included

TEGL Windows Toolkit lets you create DOS based GUI apps that are completely standalone. Over 500 functions. Menus, mouse & keyboard support, dialogues, and more. Includes TEGL graphics interface which has drivers for most popular video modes. Supports most C and Pascal compilers. Protected mode version is only \$499. No royalties.

#### TEGL Systems Corporation

P.O. Box 580, Stn. A, Vancouver B.C. V6C 2N2  
(604) 669-2577 FAX (604) 688-9530

Inquiry 783.

## SOFTWARE/PACKAGING

### FREE SOFTWARE PACKAGING CATALOG

Everything you will need to Package, Distribute, and Ship Your Software! From manuals and binders to mailers and shippers

#### LABELS • LABELS • LABELS

For your diskettes, plain or custom printed dot matrix or laser printer... free samples

#### ...FREE CATALOG...

#### Hice & Associates

8586 Monticello Dr., West Chester, OH 45069  
Phone/Fax: 513-777-8586

Inquiry 784.

## SOFTWARE/SCIENTIFIC

### Weather Monitor & Weatherlink!

The ultimate in weather monitoring systems! A state-of-the-art weather station and a PC link allow you to view, record, summarize, and graph weather information. The perfect marriage of computer and weather technology.

#### DAVIS INSTRUMENTS

3465 Diablo Avenue, Hayward, CA 94545  
1-800-678-3669 FAX 1-510-670-0589

BY22

Inquiry 785.

### NEW! MathViews™ for Windows

MATLAB compatible interpreter for Windows

- Matrix and Array Algebra
- Complex Numbers and Signal Processing
- 2D and 3D Graphics with Clipboard Support
- Written in C++ / Available for OEM
- Introductory Price \$495.00

#### The MathWizards

(619) 457-2971 FAX (619) 458-5849

Trademarks are the properties of their respective owners.

Inquiry 786.

### VT<sub>E</sub>X Scientific Desktop Publishing

- Equations • Tables • Graphics • Scalable Fonts • Supports most printers • WYSIWYG previewer • Foreign Languages • Special Symbols • Font Effects • Indices • Only \$299
- \*TeX of Tomorrow\*-Notices of AMS, March 1991.

#### MicroPress, Inc.

68-30 Harrow Street, Forest Hills, NY  
Tel (609) 497-0008 Fax (609) 497-0917

Inquiry 787.

## SOFTWARE/SORT

### OPT-TECH SORT/MERGE

Extremely fast Sort/Merge/Select utility. Run as an MS-DOS command or CALL as a subroutine. Supports most languages and file types including Btrieve and dBASE. Unlimited file sizes, multiple keys and much more! MS-DOS \$149. OS/2, XENIX, UNIX \$249.

(702) 588-3737

#### Opt-Tech Data Processing

P.O. Box 678 - Zephyr Cove, NV 89448

Inquiry 788.

## SOFTWARE/VOICE/FAX

### MULTI-VOICE® TOOLS

Multi-Voice Tools is a complete development Toolkit for Pascal or "C" to access all the features for most speech processing boards available today. It helps you write MULTI-VOICE APPLICATION systems in minutes. A number of programming examples are provided. All programs and libraries are delivered with source code.

Dialogic, Rhetorex, Pika, VBX: \$599. Watson (Single Line): \$99. ALSO AVAILABLE: Fax Programmer's Toolkit (\$199). Based on CAS specifications. Visa/MC accepted.

#### ITI Logiciel

4263 Cristophe-Colomb, Montreal, Quebec, Can. H2J 3G2  
TEL (514) 597-1692 FAX (514) 526-2362

Inquiry 789.

## STATISTICS

### VISUALIZE YOUR DATA

MCA+ transforms most marketing and social science data to easily understood perceptual maps. Communicate complex relations with ease using presentation quality charts. Most printers supported. Demos available.

#### Bretton-Clark

89 Headquarters Plaza, Morristown, NJ 07960  
(201) 993-3135 FAX: (201) 993-1757

Inquiry 789.



## OCTOBER 1992 • BYTE 339



# YOUR DIRECT LINK

## ADVERTISER CONTACT INFORMATION

To order products or request **FREE** information, call advertisers directly or send in the Direct Link Card by mail or fax! **Let them know you saw it in BYTE!**

Inquiry No.	Page No.	Phone No.	Inquiry No.	Page No.	Phone No.	Inquiry No.	Page No.	Phone No.			
<b>A</b>											
61-62	ABACUS SOFTWARE	143	800-451-4319	395-397	CYBER RESEARCH	314	800-394-3300	277	KILA	325	303-444-7737
364-365	ABC COMPUTER	274IS-2		234	CYBEX CORP	306	205-534-0010**	418-419	KINGLI TECHNOLOGY, INC	314MW-6	800-788-0622
259-260	ABC COMPUTER (USA) CORP	300	310-325-4005	380	CYBEX CORP (INT'L)	CIII	205-534-0010**	431-432	KINGLI TECHNOLOGY, INC	314NE-4	800-788-0622
309-310	ACI/ACQUIRE	325	886-2-758-9615**					346-347	KUO FENG CORP	194IS-15	886-2-754-8498**
197-198	ADDA	272	886-2-248-4276**	<b>D</b>				354-355	KYE SYSTEMS CORP	194IS-5	886-2-9956649**
423-424	ADVANCED COMP INT'L	314MW-3	800-345-1828	330	DAN TECHNOLOGY PLC	186UK-1	44-81-902-3300**	<b>L</b>			
440-441	ADVANCED COMP INT'L	314SO-3	800-345-1828	93-94	DATA ACCESS CORP	145	800-451-FLEX	278	LAGUNA DATA SYS	329	800-859-8856
227-228	ADVANCED COMPUTER PROD	310	714-558-8813	414	DATA PRODUCTS & SERV	166IS-1	303-667-8260	122	LAHEY COMPUTER SYS	116	800-548-4778
459-460	ADVANCED LOGIC RESEARCH	98-99	714-581-6770	95-96	DATALUX CORP	152	800-DATALUX	176-177	LANDMARK RSCH INT'L CORP	131	800-683-6696
67	ADVANCED MICRO DEVICES	44-45	800-222-9323	326	DATAMAN LTD	226UK-4	44-0300-21012**	254-255	LAPINE	294-295	800-927-3772
425	ALADDIN KNOWLEDGE SYS	314NE-4	800-223-4277	327	DATASTORM TECH	234UK-4		279	LAWSON LABS INC	326	800-321-5355
426	ALADDIN KNOWLEDGE SYS	314NE-5	800-223-4277	317-318	DAVISON-WORTH CORP	328	800-668-2707	302	L-COM, INC	325	508-682-6936
366	ALADDIN KNOWLEDGE SYS	6	972-3-537-5796**	97	DELL COMPUTER CORP (N.A.)	CIII	800-626-8260	203-204	LEXMARK INT'L	63	606-232-6814
63	ALADDIN KNOWLEDGE SYS	61	800-223-4277	98	DELL COMPUTER CORP (N.A.)	CIV	800-626-8260	201-202	LIANT SOFTWARE CORP (INT'L)	273	44-0-71-799-2434
64-66	ALPHATRONIX	203	800-849-5807	436	DEXPO/			199-200	LIANT SOFTWARE CORP (N.A.)	273	800-662-9866
229	ALTEX ELECTRONICS	298-299	800-531-5369		MILLER FREEMAN, INC	314PC-3	800-87-DEXPO	123	LIBREX	56-57	
*	AME INSTIT FOR COMP SCI	330	205-323-6191	454-455	DHT	314SO-4-5	818-810-0552	280	LINK COMPUTER GRAPHICS	328	201-808-8990
*	AMERICA ONLINE INC	178A-B	800-827-6364	350-351	DIGICOM INC	194IS-13	886-2-721-4052**	249	LODE STAR COMPUTER	286-287	800-875-7568
68-69	AMERICAN MEGATRENDS	107	800-828-9264	100	DIGITAL RESEARCH INC (N.A.)	191	800-274-4DR1	<b>M</b>			
70	AMERICAN POWER CONV	218	800-800-4APC	325	DIGITAL SOUP INC	332	800-793-7356	386	MAGIC/MSE (INT'L)	178IS-4	972-3-751-1901**
71	AMERICAN SMALL BUS COMP	55	918-825-4844	99	DIGITALK INC	245	800-531-2344	*	MANCHESTER EQUIP CO	314NE-A-B	516-435-1199
230	AMT INT'L	321	408-942-9695	268	DIVERSIFIED COMPUTER	329	303-447-9251	429	MANCHESTER EQUIP CO	314NE-1	516-435-1199
174	APL * PLUS/MANUGISTICS INC	165	800-592-0050	101	DOLCH COMPUTER SYS	71	800-995-7581	*	MARK WILLIAMS CO	119	800-627-5967
437	APPRO INT'L INC	314SO-1	408-732-6091	235-236	DPT	293	407-830-5522	125	MATHSOFT INC	229	800-628-4223
442	APPRO INT'L INC	314PC-2	408-732-6091	102	DSP DEVELOPMENT CORP	177	617-577-1133	126	MATHSOFT INC	250	800-628-4223
*	APS TECHNOLOGIES	297	800-235-3707	253	DYNAMICSCAN	302-303	314-423-0044	*	MCGRW HILL NRI (N.A.)	194A-B	
72-73	ARC SOFTWARE	116		210-211	DYNATEK AUTOMATION SYS	258	416-636-3000	443	MEGA DRIVE SYSTEMS	211	310-247-0006
75	ASP COMPUTER PRODUCTS	166	408-746-2965	412	ECG	136IS-3	31-4937-96808**	387	MEGADATA	250IS-2	516-589-6858**
462-463	AST RESEARCH INC	92-93	800-876-4AST	*	ELONEX (INT'L)	80-81	44-81-452-6422**	263	MEGAMEDIA COMPUTER CORP	313	800-634-2633
74	ATI TECHNOLOGIES INC	232	416-756-0718	312	EMPIRE COMPUTECH	327	800-446-1967	301	MEMORY SUPERSTORE	327	800-800-7056
258	ATLAS INDUSTRIES INC	307	800-ATLAS-11	382	EUTRON	250IS-2	39-35-692-229**	306	METALINK CORPORATION	328	800-638-2423
314	ATLAS INDUSTRIES INC	324	800-ATLAS-11	427-428	EVOLUTION COMPUTING	314NE-3	800-874-4028	220	M-H INTERAMERICA DE MEXICO	270	
362-363	AUTO COMPUTER CO. LTD	194IS-11	886-3-452-9155**	434-435	EVOLUTION COMPUTING	314PC-1	800-874-4028	388	MICRO DESIGN INT'L	136IS-1	407-677-8333
106-107	AUTODESK RETAIL PROD	262	800-228-3601	<b>F</b>				305	MICRO HOUSE	332	800-926-8299
303-304	AXIOM	324	886-2-917-3200**	383	FAST ELECTRONIC GMBH	166IS-3	49-089-533-401**	242	MICRO SOLUTIONS COMP PROD	315	815-756-3411
<b>B</b>				238-239	FIRST SOURCE INT'L	320	714-588-9866	127-128	MICRONET TECHNOLOGY	197	714-837-6033
231-232	BAY TECHNICAL ASSOC	309	800-523-2702	*	FRAME TECHNOLOGY	153-154	800-U4FRAME	241	MICROPROSE SOFTWARE	301	800-879-PLAY
450	BIX	347	617-491-3342	103	FRAME TECHNOLOGY	155	800-U4FRAME	*	MICROSOFT CORP	8-9	
329	BLACKWELL SOFTWARE	226UK-1	44-0865-721205**	104-105	FTP SOFTWARE (N.A.)	6	617-246-0900	*	MICROSOFT CORP	188-189	
206	BLINK INC	217	804-355-4444	221	FUNK SOFTWARE	91	617-497-6339	*	MICROSOFT PRESS INC	102	
76-77	BORLAND INT'L	11-15,17	800-331-0877	<b>G</b>				282	MICROSTAR LABORATORIES	326	206-453-2345
367-368	BORLAND INT'L	CIV		*	GATEWAY 2000	CII, 1	800-523-2000	130-131	MICROTEST	79	800-526-9675
331	BRAIN BOXES	234UK-2	44-51-252-0446**	*	GATEWAY 2000	CII A-B	800-523-2000	132	MICROWAY	221	508-746-7341
207	BROWN WAGH PUBLISHING	226	800-451-0900	451	GENOA SYSTEMS	169		133	MICROWAY	276	508-746-7341
399	BUFFALO PRODUCTS	219	800-345-2356	384	GFK HAMBURG	250IS-3	49-040-231-789**	409	MINICOM LTD	178IS-3	972-2-637576
233	BULLDOG COMPUTER PROD	288	800-438-6039	108-109	GLENCO ENGINEERING	207	800-562-2543	389	MINOLTA GMBH (INT'L)	266IS-1	49-0511-779089*
458	BYTE BACK ISSUES	339		269	GLOBALINK INC	332	800-255-5660	140	MINUTEMAN	117	214-446-7363
78	BYTE PUBLICATIONS	345	603-924-9281	270	GMM RESEARCH CORP	325	714-752-9447	341-342	MITAC	194IS-9	
*	BYTE REPRINTS	244	603-924-2525	307	GRAMMAR ENGINE, INC	330	614-899-7878	323	MITREFINCH LTD	326	
*	BYTE SUB MESSAGE	156		*	GRANICOR	328	415-244-9999	390	MIX SOFTWARE	266IS-4	214-783-6001
<b>C</b>				271	GREENLEAF SOFTWARE	331	800-523-9830	391	MORTICE KERN (MKS)	136IS-4	519-884-2225
79	CALERA RECOGNITION SYS	112		385	GREY MATTER LTD	274IS-1	44-0364-53071**	360-361	MOXA	194IS-8	
80	CANON USA INC	108	800-221-3333	272	GTEK INC	325	800-282-4835	<b>N</b>			
81	CAPITAL EQUIPMENT CO	170	800-234-4232	273	GTEK INC	328	800-282-4835	334	NAG	186UK-4	44-865-310139*
82	CAPITAL EQUIPMENT CO	171	800-234-4232	<b>H</b>				134-135	NANAO USA CORP	104-105	310-325-5202
222-223	CASE DESIGN INT'L	35	800-880-1100	*	HARD DRIVES INT'L	308	800-998-8013	243-244	NATIONAL DESIGN	305	800-253-883
208	CASTELLE CORP	49	800-359-7654	321	HARPER COLLINS	329	44-0903-736333*	*	NATIONAL INSTRUMENTS	136IS-5-6	800-433-3488
344-345	CATHAY COMP & TECH	194IS-10	886-2-506-8929**	110	HAUPPAUGE COMP WORKS	36-37	800-443-6284	283	NATIONAL INSTRUMENTS	330	800-433-3488
319-320	CHAI SHIN	324	886-2-9619586**	422	HC & E	314MW-5	408-441-6035	452	NEC	110-111	800-366-0474
369	CHERRY MIKROSCHALTER			274	HIGH-RES TECHNOLOGIES	328	416-497-6493	205	NETWORK COMPUTING DEV	183	800-800-9599
251	CITITRONICS	304	818-855-5688	275	HI-TECH INSTRUMENTS	324	713-980-9040	240	NEVADA COMPUTER	292	800-654-7762
370-371	CLARION SOFTWARE	166IS-4	305-785-4555	111	HUMMINGBIRD COMMNTS	261	416-470-1207	*	NORTHGATE COMP SYS	181	800-345-8709
375	COBALT BLUE	178IS-3	404-640-1182**	<b>I</b>				*	NORTHGATE COMP SYS	230-231	800-345-8709
83-84	COLORADO MEMORY SYS	85	800-346-9881	112	IBM OS/2	28-29	800-3-IBM-OS2	*	NORTHGATE COMP SYS	237	800-345-8709
433	COMMAX TECH, INC	314PC-4	800-526-6629	335	ICONOGRAPHIC SYS	186UK-2	44-0280-823-314**	381	NOVELL	191	44-0-635-3135
85	COMPAQ COMPUTER CORP	126-127	800-345-1518	113	IDEX IYAMA	115	215-957-6543	<b>O</b>			
372-373	COMPEX INC	178IS-1	714-630-7302	217	IMAGE WATCHES	271	800-344-8050	313	OMEGA POINT, INC	331	508-877-1811
86	COMPUADD EXPRESS	40-41		338	INST OF ANALYSTS & PROGRAMMERS	186UK-2	44-81-567-4379**	215	OMRON OFFICE AUTO PROD	23	800-362-441
87	COMPUCLASSICS	264	800-827-1994	114	INTEGRAND RESEARCH	118	209-651-1203	411	ON TIME MKT/		
216	COMPUDYNE	50-51	800-932-COMP	115	INTEL CORP	18-19	800-538-3373	136-137	KARSTEN PETERSEN	178IS-3	49-040-435-196*
374	COMPUSEAVE INT'L	178IS-2	602-437-8208	117-119	INTERGRAPH (N.A.)	248	800-345-4856	300	OPTIQUEST	147	310-948-118
88	COMPUSEAVE	120-121	800-848-8199	276	IO TECH	328	216-439-4091	*	OSCS	332	800-545-139
89	COMPUTER ASSOCIATES	39	800-CALL-CAI	311	IVERSON SOFTWARE, INC	331	416-925-6096	*	OUTPUT TECHNOLOGY CO	95	800-468-878
91	COMPUTER ASSOCIATES	97	800-CALL-CAI	<b>J</b>				284	OVERLAND DATA INC	329	800-729-872
90	COMPUTER ASSOCIATES	148	800-CALL-CAI	120	JAMECO ELECTRONICS	32-33	800-831-4242	392	OXFORD ELECTRONIC PUBL	274IS-3	44-865-56646*
377	COMPUTER QUICK	166IS-2	415-861-8330	*	JDR MICRODEVICES	317	800-538-5000	<b>P</b>			
339	COMPUTER TELECOMMNTS	234UK-2	44-252-835315**	410	JEN ELECTRONICA	274IS-4	39-73-3224035**	*	PACIFIC DATA PRODUCTS	88-89	619-597-463
376	COMPUTERLANE UNLTD	187	800-526-3482	<b>K</b>				139	PANASONIC	72-73	800-742-808
447-448	COMTRADE	322	800-969-2123	121	KEA SYSTEMS LTD	106	800-663-8702	212	PARALLEL PERIPHERALS	209	714-394-724
415	CORDATA	266IS-3	31-2503-37214**	281	KEITHLEY METRABYTE	326	508-880-3000	285	PATTON & PATTON	330	800-525-008
378-379	CORE INT'L	100	407-997-6044					141-142	PC POWER & COOLING	103	800-722-655
92	COREL SOFTWARE	46	800-836-SCSI					143-144	PERISCOPE COMPANY, THE	174	800-722-700
336	CORPORATE HI TECH SERV	186UK-2	44-0793-611-437**					145	PERSOFT INC	238	800-368-528
266	CURTIS INC	324	612-631-9512					146	PHAR LAP SOFTWARE INC	43	617-661-151



# YOUR DIRECT LINK

## ADVERTISER CONTACT INFORMATION

Inquiry No.	Page No.	Phone No.	Inquiry No.	Page No.	Phone No.	Inquiry No.	Page No.	Phone No.			
393	PHILIPS MONITORS	82-83	31-40-73-39-83**	164	S'NW ELECTRONICS	272	800-874-1235				
147-148	PINNACLE MICRO	59	714-727-3300	*	SOFTLINE CORP	136IS-2	718-438-6057	246-247	ULTIMA ELECTRONICS CORP	321	886-2-788565**
149	PIONEER COMMUNICATIONS	129	800-LASER-ON	165-166	SOFTWARE SECURITY INC	253	203-329-8870	*	ULTIMATE TECHNOLOGY	136IS-5-6	31-2159-43345**
150	PKWARE INC	260	414-354-8677	167	SONY CPCC	136A-H	800-352-7669	406-407	UNIAIR	250IS-4	886-2-2993210**
417	PLUSTEK USA, INC	314MW-2	408-980-1234	168	SPECTRUM SOFTWARE (N.A.)	187	408-738-4387	*	UNIXWORLD	242A-B	800-257-9402
286	POLAROID CORP	324	800-225-2770	169	SPSS INC	141	800-543-5835	*	UNIXWORLD	243	800-257-9402
352-353	PORA CORP	194IS-12	886-2-883582**	446	STATGRAPHICS/						
430	PROFESSIONAL COMP	314NE-6	408-263-0222		MANUGISTICS INC	222	800-592-0050				
*	PROGRAMMER'S PARADISE	65	800-445-7899	170-171	STATSOFT	139	918-583-4149	186	VERBATIM CORP	161	
124	PROGRAMMER'S PARADISE	66-67	800-445-7899	172	STORAGE DIMENSIONS	194	408-954-0710	*	VERMONT CREATIVE S/W	21	800-848-1248
*	PROGRAMMER'S SHOP (N.A.)	80A-B	800-421-8006	173	STRATEGIC MAPPING	240	408-985-7400	187	VIDEX, INC	176	503-758-0521
*	PROGRAMMER'S SHOP (N.A.)	80-83	800-421-8006	413	STRUCTURED S/W SOLU	274IS-3	214-985-9901	188-189	VIEWSONIC	157	714-869-7976
151-152	PROGRESS SOFTWARE	173	800-4PROGRESS	175	SUMMAGRAPHS CORP	239		224-226	VILLA CRESPO S/W LTD	135	800-521-3963
153	PROMISE TECHNOLOGY	163	800-888-0245	461	SUMMIT MICRO DESIGN	314SO-2	408-739-6348	328	VOGON ENTER LTD	226UK-3	44-734-890040**
287	PSEUDOCORP	331	804-873-1947	416	SUMMIT MICRO DESIGN	314MW-1	408-739-6348				
				209	SUNSOFT	2-3	800-227-9227				
155	QUA TECH INC	284	800-553-1170	322	SURPLUS SOFTWARE INT'L	330	800-753-7877	408	WALKER, RICHER & QUINN	250IS-1	206-324-0407
288	QUALSTAR CORP	329	818-882-5822	178-179	SYSTAT INC	109	708-864-5670	190	WATCOM PRODUCTS INC	27	800-265-4555
154	QUARTERDECK OFFICE SYS	185	310-392-9851	333	SYSTEMSTAR	234UK-3	44-0992-554-261**	191	WATCOM PRODUCTS INC	75	800-265-4555
337	QUIN SYSTEMS LTD	234UK-1	44-734-776728**	161	SZKI RECOGNITA CORP	133	361-201-7607**	444-445	WEN TECHNOLOGY CORP (N.A.)	249	800-377-4WEN
								332	WESTPOINT CREATIVE	186UK-3	44-0743-248-199**
								295	WINTK CORP	324	800-742-6809
								194	WORDPERFECT CORP	31	
156	RAIMA CORP	87	800-327-2462	290	TALKING TECHNOLOGY INC	325	800-685-4884	250	WORLDWIDE TECHNOLOGIES	316	800-457-6937
159-160	RAINBOW TECHNOLOGIES	113	800-852-8569	348-349	TATUNG CO	194IS-7	886-2-598-4509**				
157-158	RAINBOW TECHNOLOGIES	160	800-852-8569	291	TECHNOLOGY PWR ENTER	326	510-623-3818				
*	RALIN WHOLESALE	289	800-752-9512	402-403	TECHPOWER CO LTD	166IS-2	886-2-753-1940**	296	XELTEK	329	408-524-1929
256-257	RALIN WHOLESALE	290-291	800-752-9512	400-401	TECHPOWER CO LTD	266IS-2	886-2-753-1940**	192-193	XVT SOFTWARE INC	156	
*	REASONABLE SOLUTIONS	136IS-5-6	503-776-5777	180	TEKTRONIX	193	800-835-6100				
456-457	RECORTEC INC	314SO-6	800-729-7654	181	TEXAS INSTRUMENTS	7	800-527-3500				
162	ROSE ELECTRONICS	274	800-333-9343	358-359	TOPEK	194IS-3	886-2-961-9586**				
340	R.E.M.	226UK-2	44-71-436-4420**	182	TOSHIBA AMERICA INC	24-25	800-457-7777	437-438	YUAN TECHNOLOGY INC	314PC-4	
				449	TOTE-A-LAP	323	800-9-LAPTOP				
289	SAS INSTITUTE INC	331	919-677-9000	261-262	TRANSCEND INFO INC	311	714-598-5500	356-357	ZECKS	194IS-16	886-2-299-2027**
252	SECURTECH CO	318	503-636-6831	298	TRANSTOR SYSTEMS LTD	326	510-770-1400	264-265	ZENTEK	318	516-678-1688
163	SEQUIER SOFTWARE INC	225	403-437-2410	299	TRI VALLEY TECHNOLOGY INC	325	510-447-2030	195	ZEOS INT'L	76-77	800-423-5891
292	SIGEN	327	408-737-3904	293-294	TRIBAL MICROSYSTEMS	329	510-623-8859	297	Z-WORLD ENGINEERING	329	916-757-3737
315	SIGMA TECH SOFTWARE	325	818-368-6132	183-184	TRIPP LITE	114	312-329-1777	196	ZYLAB/DIVISION OF IDI	244	800-544-6339
308	SMARTMICRO TECHNOLOGIES	327	800-266-1576	245	TRUE DATA PRODUCTS	319	800-635-0300	213-214	ZYXEL USA	175	714-693-0808
				185	TURBOPOWER SOFTWARE	269	800-333-4160				

\* Correspond directly with company.

\*\* Indicates FAX NUMB

\* Correspond directly with company.  
\*\* Indicates FAX Number

### BYTE ADVERTISING SALES STAFF

Jennifer L. Bartel, National Sales Manager, 14850 Quorum Drive, Suite 380, Dallas, TX 75240, Tel. (214) 701-8496  
Liz Coymann, Inside Advertising Sales Director, One Phoenix Mill Lane, Peterborough, NH 03458, Tel. (603) 924-2518

#### NEW ENGLAND

ME, NH, VT, MA, RI, CT, ONTARIO  
CANADA & EASTERN CANADA  
Michael Lamattina (617) 860-6344  
Patricia Payne (603) 924-2654  
McGraw-Hill Publications  
24 Hartwell Avenue  
Lexington, MA 02173  
FAX: (617) 860-6899

#### EAST COAST

NY, NYC, NJ, DC, DE, MD, VA, WV, PA  
Kim Norris (212) 512-2645  
Ariane Casey (212) 512-2368  
Barry Echavarría (603) 924-2574  
McGraw-Hill Publications  
1221 Avenue of Americas—  
28th Floor  
New York, NY 10020  
FAX: (212) 512-2075

#### SOUTHEAST

NC, SC, GA, FL, AL, TN, MS, AR, LA, KY  
MaryAnn Goulding (404) 843-4782  
McGraw-Hill Publications  
4170 Ashford-Dunwoody Rd., Suite 520  
Atlanta, GA 30319  
FAX: (404) 252-4056

#### MIDWEST

IL, MO, KS, IA, ND, SD, MN,  
WI, NE, IN, MI, OH  
Kurt Kelley (312) 616-3328  
Ed Ware (603) 924-2664  
McGraw-Hill Publications  
Two Prudential Plaza  
180 North Stetson Ave.  
Chicago, IL 60601  
FAX: (312) 616-3370

#### SOUTHWEST

ROCKY MOUNTAIN  
CO, OK, TX  
Jennifer Walker (214) 701-8496  
Barry Echavarría (603) 924-2574  
McGraw-Hill Publications  
14850 Quorum Dr., Suite 380  
Dallas, TX 75240  
FAX: (214) 991-6208

#### NORTH PACIFIC: San Francisco, CA

NORTHERN CA, OR, ID, MT,  
WY, NORTHERN NV, UT  
Roy J. Kops (415) 954-9728  
Joseph Mabe (603) 924-2662  
McGraw-Hill Publications  
425 Battery Street  
San Francisco, CA 94111  
FAX: (415) 954-9786

#### NORTH PACIFIC: Campbell, CA

SILICON VALLEY, HI, WA, AK,  
W. CANADA  
Bill McAfee (408) 879-0381  
Jonathan Sawyer (603) 924-2665  
McGraw-Hill Publications  
1999 South Bascom Ave., Suite 210  
Campbell, CA 95008  
FAX: (408) 879-9067

#### SOUTH PACIFIC: Los Angeles, CA

LOS ANGELES COUNTY, AZ,  
NM, SOUTHERN NEVADA  
Alan El Faye (213) 480-5243  
Jonathan Sawyer (603) 924-2665  
McGraw-Hill Publications  
3333 Wilshire Boulevard #407  
Los Angeles, CA 90010  
FAX: (213) 480-5249

#### SOUTH PACIFIC: Costa Mesa, CA

ORANGE COUNTY  
SAN DIEGO COUNTY  
Beth Dudas (714) 753-8140  
Joseph Mabe (603) 924-2662  
McGraw-Hill Publications  
15635 Alton Pkwy., Suite 290  
Irvine, CA 92718  
FAX: (714) 753-8147

#### Regional Advertising

Brian Higgins (603) 924-2651  
Larry Levine (603) 924-2637  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

#### BYTE International Direct

Response Postcards  
Ellen Perham (603) 924-2596  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

Peterborough, NH Office: Inside Sales FAX: 603-924-2683 Advertising FAX: 603-924-7507

#### Hardware/Software Showcase

Mark Stone (603) 924-2695  
Ellen Perham (603) 924-2596  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

#### The Buyer's Mart (1-2)

Margot Grady (603) 924-2656  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

#### BYTE Deck

Brad Dixon (603) 924-2596  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

#### EURO-DECK

James Ball (603) 924-2533  
BYTE Publications  
One Phoenix Mill Lane  
Peterborough, NH 03458

### INTERNATIONAL ADVERTISING SALES STAFF

Ron Cordek, Managing Director, European Operations  
McGraw-Hill Publishing Co., Wimbledon Bridge House, One Hartfield Road, Wimbledon, London SW19 3RU, England, Tel: 44 81 545 6278, Fax: 44 81 545 6294

#### GERMANY, SWITZERLAND, AUSTRIA

Christina Barion  
McGraw-Hill Publishing Co.  
Wimbledon Bridge House  
One Hartfield Road  
Wimbledon, London SW19 3RU  
England  
Tel: 44 81 545 6270  
FAX: 44 81 545 6294  
TELEX: 892191

#### BENELUX

Ellen Pardebe  
Batenburg 105  
3437 AB Nieuwegein  
The Netherlands  
Tel: 31 34 02 49496  
FAX: 31 34 02 37944

#### UNITED KINGDOM

Michele Hams (44 81 545 6269)  
Christina Barion (44 81 545 6270)  
McGraw-Hill Publishing Co.  
Wimbledon Bridge House  
One Hartfield Road  
Wimbledon, London SW19 3RU  
England  
Tel: 44 81 545 6294  
TELEX: 892191

#### FRANCE, ITALY

Zena Coupé, Amanda Blaskett  
A-Z International Sales Ltd.  
70 Chalk Farm Road  
London NW1 8AN  
England  
Tel: 44 71 284 3171  
FAX: 44 71 284 3174

#### SCANDINAVIAN COUNTRIES

Zena Coupé  
A-Z International Sales Ltd.  
McGraw-Hill Publishing Co.  
London NW1 8AN  
England  
Tel: 44 71 284 3171  
FAX: 44 71 284 3174

#### ISRAEL

Dan Ehrlich  
Ehrlich Communication Int'l.  
P.O. Box 99  
Herzliya 46101, Israel  
Tel: 972-52-586 245  
Tel: 972-52-586 246  
FAX: 972-52-585 685

#### AUSTRALIA

Rod Tremain  
Rod Tremain Media  
45 Pyrmble Ave.  
Pyrmble 2073, Sydney  
Australia  
Tel: 2-998-3339  
FAX: 2-988-3424

#### JAPAN

Masaki Mori  
Erewhon  
4th Floor, 1-26-6 Kamimeguro  
Meguro-ku, Tokyo 153, Japan  
Tel: 011-81-3-5721-0761  
FAX: 011-81-3-5721-0762

#### KOREA

Young-Seoh Chinn  
JES MEDIA INT'L  
5th Floor, Banpo Bldg.  
40-7, Chamwon-Dong, Seocho-Gu  
Seoul 137-030, Korea  
Tel: 011-(82) 2 545-8001/2  
FAX: 011-(82) 2 549-8861

#### SINGAPORE

Stephen Tay  
Acer TWP Corp.  
1123 Serangoon Road, #03-01  
Singapore 1232  
Tel: 011-65-296-6166  
FAX: 011-65-296-7551

#### MALAYSIA

Servex (Malaysia) Sdn. Bhd.  
H.K. Lin  
5th Floor, Bena Tower  
160, Jalan Ampang  
50450 Kuala Lumpur, Malaysia  
Tel: (03) 262-4592  
FAX: (03) 262-4591

#### THAILAND

Jack Hu  
28/1 Prapawit Bldg., Surasak Rd.  
Siom, Bangkok 10500  
Thailand  
Tel: 662-236-0295  
FAX: 662-236-5960

#### HONG KONG

Candice Lo  
Acer TWP Corp.  
Unit 2, 8F Hing Wah Center  
82-84 To Kwa Wan Road  
Kowloon, Hong Kong  
Tel: 011-852-764-3830  
FAX: 011-852-764-3857

#### INDIA, INDONESIA, PAKISTAN, PHILIPPINES, TAIWAN, OTHER ASIAN AND PACIFIC COUNTRIES

K.T. Wu  
Acer TWP Corp.  
2nd Fl., No. 19-1, Lane 231  
Fu Hsing North Road  
Taipei 10445, Taiwan  
R.O.C.  
Tel: 011-(886) 2 713 6959  
FAX: 011-(886) 2 715 1950



# YOUR DIRECT LINK

## PRODUCT CATEGORY INDEX

For FREE product information from individual advertisers, circle the corresponding inquiry numbers on Your Direct Link Card!

To receive information for an entire product category, circle the category number on Your Direct Link Card!

Category No. Inquiry No.	Page No.	Category No. Inquiry No.	Page No.	Category No. Inquiry No.	Page No.
<b>HARDWARE</b>					
<b>1 ACCESSORIES/SUPPLIES</b>				<b>14 MAIL ORDER</b>	
422 HC & E 314MW-5		* NORTHGATE COMPUTER SYSTEM 230-231		227-228 ADVANCED COMPUTER PRODUCTS 310	
286 POLAROID CORP 324		* NORTHGATE COMPUTER SYSTEM 237		229 ALTEX ELECTRONICS 298-299	
252 SECURTECH CO 318		381 NOVELL 191		230 AMT INTERNATIONAL 321	
356-357 ZECKS 194IS-16		141-142 PC POWER & COOLING 103		233 BUILDG COMPUTER PRODUCTS 288	
<b>2 ADD-IN BOARDS</b>		430 PROFESSIONAL COMPUTER 314NE-6		458 BYTE BACK ISSUES 339	
68-69 AMERICAN MEGATRENDS 107		456-457 RECORTEC INC 228UK-2		78 BYTE PUBLICATIONS 345	
74 ATI TECHNOLOGIES INC 232		461 R.E.M. 314SO-2		251 CITITRONICS 304	
314 ATLAS INDUSTRIES INC 324		416 SUMMIT MICRO DESIGN 314MW-1		86 COMPUADD EXPRESS 40-41	
303-304 AXIOM 324		348-349 TATUNG CO 194IS-7		376 COMPUTERLANE UNLTD 187	
331 BRAIN BOXES 234UK-2		291 TECHNOLOGY POWER ENTERPRISE 326		395-397 CYBER RESEARCH 314	
319-320 CHAI SHIN 324		402-403 TECHPOWER COMPANY LTD 266IS-2		422 HC & E 314MW-5	
372-373 COMPEX INC 178IS-1		400-401 TECHPOWER COMPANY LTD 266IS-2		120 JAMECO ELECTRONICS 32-33	
378-379 CORE INTERNATIONAL 100		299 TRI VALLEY TECHNOLOGY INC 325		* JDR MICRODEVICES 317	
266 CURTIS INC 324		245 TRUE DATA PRODUCTS 319		302 L-COM, INC 325	
350-351 DIGICOM INC 194IS-13		246-247 ULTIMA ELECTRONICS CORP 321		248 LODE STAR COMPUTER 286-287	
235-236 DFT 293		406-407 UNIAIR 250IS-4		240 NEVADA COMPUTER 292	
451 GENOA SYSTEMS 169		195 ZEOS INTERNATIONAL 76-77		264-265 ZENTEK 318	
384 GFK HAMBURG 250IS-3		<b>6 DATA ACQUISITION</b>		<b>15 MEMORY/CHIPS/UPGRADES</b>	
274 HIGH-RES TECHNOLOGIES 328		281 KEITHLEY METRABYTE 326		459-460 ADVANCED LOGIC RESEARCH 98-99	
275 HI-TECH INSTRUMENTS 324		279 LAWSON LABS INC 326		67 ADVANCED MICRO DEVICES 44-45	
120 JAMECO ELECTRONICS 32-33		282 MICROSTAR LABORATORIES 326		81 CAPITAL EQUIPMENT CO 170	
410 JEN ELECTRONICA 274IS-4		323 MITREFINCH LTD 330		82 CAPITAL EQUIPMENT CO 171	
133 MICROWAY 276		* NATIONAL INSTRUMENTS 136IS-5-6		326 DATAMAN LTD 226UK-4	
360-361 MOXA 194IS-8		337 QUIN SYSTEMS LTD 234UK-1		238-239 FIRST SOURCE INT'L 320	
243-244 NATIONAL DESIGN 305		<b>7 DISK &amp; OPTICAL DRIVES</b>		110 HAUPPAUGE COMP WORKS 36-37	
143-144 PERISCOPE COMPANY, THE 174		64-66 ALPHATRONIX 203		115 INTEL CORP 18-19	
153 PROMISE TECHNOLOGY 163		68-69 AMERICAN MEGATRENDS 107		120 JAMECO ELECTRONICS 32-33	
* QUA TECH INC 284		* APS TECHNOLOGIES 297		301 MEMORY SUPERSTORE 327	
256-257 RALIN WHOLESALERS 290-291		378-379 CORE INTERNATIONAL 100		308 SMARTMICRO TECHNOLOGIES 327	
358-359 TALKING TECHNOLOGY INC 194IS-3		210-211 DYNATEK AUTOMATION SYSTEMS 258		261-262 TRANSCEND INFORMATION INC 311	
332 TOPEK 186UK-3		* HARD DRIVES INTERNATIONAL 308		250 WORLDWIDE TECHNOLOGIES 316	
295 WESTPOINT CREATIVE 194IS-3		443 MICRO DESIGN INTERNATIONAL 136IS-1		<b>16 MISCELLANEOUS HARDWARE</b>	
187 WINTEK CORP 324		388 MICRO SOLUTIONS COMP PROD 315		414 DATA PRODUCTS AND SERVICES 166IS-1	
<b>3 BAR CODING</b>		242 Pinnacle MICRO 59		217 IMAGE WATCHES 271	
187 VIDEK, INC 176		149 PIONEER COMMUNICATIONS 129		114 INTEGRAND RESEARCH 118	
<b>4 COMMUNICATIONS/NETWORKING</b>		292 SIGEN 327		159-160 RAINBOW TECHNOLOGIES 160	
414 DATA PRODUCTS AND SERVICES 166IS-1		167 SONY CPPC 136A-H		167 RAINBOW TECHNOLOGIES 136A-H	
327 DATASTORM TECHNOLOGIES 234UK-4		298 TRANTOR SYSTEMS LTD 326		<b>17 MODEMS/MULTIPLEXORS</b>	
270 GMM RESEARCH CORP 325		<b>8 DISKETTES/DUPLICATORS</b>		130-131 MICROTEST 79	
272 GTEK INC 325		186 VERBATIM CORP 161		215 OMRON OFFICE AUTOMATION PROD 23	
354-355 KYE SYSTEMS CORP 194IS-5		<b>9 FAX BOARDS/MACHINES</b>		352-353 PORA CORP 194IS-12	
302 L-COM, INC 325		339 COMPUTER TELECOMMUNICATIONS 234UK-2		256-257 RALIN WHOLESALERS 290-291	
130-131 MICROTEST 79		431-432 KINGLI TECHNOLOGY, INC 314NE-4		213-214 ZYXEL USA 175	
132 MICROWAY 221		418-419 KINGLI TECHNOLOGY, INC 314MW-6		<b>18 MONITORS &amp; TERMINALS</b>	
409 MINICOM LTD 178IS-3		352-353 PORA CORP 194IS-12		113 IDEK IYAMA 115	
212 PARALLEL PERIPHERALS 209		213-214 ZYXEL USA 175		346-347 KUO FENG CORP 194IS-15	
162 ROSE ELECTRONICS 274		<b>10 GRAPHICS TABLETS/MICE/PEN INPUT</b>		134-135 NANA O USA CORP 104-105	
315 SIGMA TECH SOFTWARE 325		354-355 KYE SYSTEMS CORP 194IS-5		136-137 OPTIQUEST 147	
290 TALKING TECHNOLOGY INC 325		175 SUMMAGRAPHICS CORP 239		393 PHILIPS MONITORS 82-83	
<b>5 COMPUTER SYSTEMS</b>		<b>11 KEYBOARDS</b>		167 SONY CPPC 136A-H	
309-310 ACI/ACQUIRE 325		369 CHERRY MIKROSCHALTER GMBH (INT'L) 248-249		188-189 VIEWSONIC 157	
423-424 ADVANCED COMPUTER INT'L 314MW-3		95-96 DATALUX CORP 152		444-445 WEN TECHNOLOGY CORP (N.A.) 249	
440-441 ADVANCED COMPUTER INT'L 314SO-3		80 LEXMARK INTERNATIONAL 63		<b>19 MULTIMEDIA</b>	
439 APPRO INTERNATIONAL INC 314SO-1		* NORTHGATE COMPUTER SYSTEM 181		197-198 ADDA 272	
442 APPRO INTERNATIONAL INC 314PC-2		* NORTHGATE COMPUTER SYSTEM 230-231		80 CANON USA INC 108	
462-463 AST RESEARCH INC 92-93		* NORTHGATE COMPUTER SYSTEM 237		312 EMPIRE COMPUTECH 327	
258 ATLAS INDUSTRIES INC 307		<b>12 LAN HARDWARE</b>		274 HIGH-RES TECHNOLOGIES 328	
344-345 CATHAY COMPUTER & TECHNOLOGY 194IS-10		231-232 BAY TECHNICAL ASSOC 309		263 MEGAMEDIA COMPUTER CORP 313	
251 CITITRONICS 304		234 BUFFALO PRODUCTS 219		417 PLUSTEK USA, INC 314MW-2	
85 COMPAQ COMPUTER CORP 126-127		380 CYBEX CORP 306		* RALIN WHOLESALERS 289	
86 COMPUADD EXPRESS 40-41		409 CYBER CORP (INT'L) CII		290-291 RALIN WHOLESALERS 290-291	
216 COMPUADYN 50-51		141-142 MINICOM LTD 178IS-3		180 TEKTRONIX 193	
447-448 COMTRADE 322		103 PC POWER & COOLING 103		332 WESTPOINT CREATIVE 186UK-3	
330 DAN TECHNOLOGY PLC 186UK-1		<b>13 LAPTOPS &amp; NOTEBOOKS</b>		437-438 YUAN TECHNOLOGY INC 314PC-4	
414 DATA PRODUCTS AND SERVICES 166IS-1		364-365 ABC COMPUTER 274IS-2		<b>20 PRINTERS/PLOTTERS</b>	
95-96 DATALUX CORP 152		259-260 ABC COMPUTER (USA) CORP 300		75 ASP COMPUTER PRODUCTS 166	
97 DELL COMPUTER CORP (N.A.) CII		362-363 AUTO COMPUTER CO. LTD 194IS-11		231-232 BAY TECHNICAL ASSOC 309	
98 DELL COMPUTER CORP (N.A.) CIV		433 COMMAX TECHNOLOGIES, INC 314PC-4		389 MINOLTA GMBH (INT'L) 266IS-1	
454-455 DHT 314SO-4-5		415 CORDATA 266IS-3		* OUTPUT TECHNOLOGY CO 95	
350-351 DIGICOM INC 194IS-13		101 DOLCH COMPUTER SYSTEMS 71		* PACIFIC DATA PRODUCTS 88-89	
253 DYNAMICSCAN 136IS-3		253 DYNAMICSCAN 302-303		139 PANASONIC 72-73	
412 CITITRONICS 304		123 LIBREX 56-57		* RALIN WHOLESALERS 289	
* ELONEX (INT'L) CII, I		* NORTHGATE COMPUTER SYSTEM 181		* RALIN WHOLESALERS 290-291	
* GATEWAY 2000 CII A-B		* NORTHGATE COMPUTER SYSTEM 230-231		180 TEKTRONIX 193	
* GATEWAY 2000 CII A-B		* NORTHGATE COMPUTER SYSTEM 237		<b>21 PROGRAMMABLE HARDWARE</b>	
112 IBM OS/2 28-29		7 TOSHIBA AMERICA INC 24-25		326 DATAMAN LTD 226UK-4	
277 KILA 325		323 TOTE-A-LAP 323		317-318 DAVISON-WORTH CORP 328	
418-419 KINGLI TECHNOLOGY, INC 314NE-4		326 VOGON ENTERPRISES LTD 226UK-3		* GRANICOR 328	
431-432 KINGLI TECHNOLOGY, INC 294-295		195 ZEOS INTERNATIONAL 76-77		273 GTEK INC 328	
254-255 LAPINE 314NE-A-B				276 IO TECH 328	
* MANCHESTER EQUIPMENT CO 314NE-1				280 LINK COMPUTER GRAPHICS 328	
429 MANCHESTER EQUIPMENT CO 250IS-2				306 METALINK CORP 328	
387 MEGADATA 194IS-9				293-294 TRIBAL MICROSYSTEMS 329	
341-342 MITAC 110-111					
452 NEC 181					
* NORTHGATE COMPUTER SYSTEM 181					



# YOUR DIRECT LINK CARD

For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

Yes, I want FREE information on the following products!

Fill out this coupon carefully. Please Print.

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Country \_\_\_\_\_ Code \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

A. What is your primary job function/principal area of responsibility? (Check one)

- 1 ☐ MIS/DIP  
2 ☐ Programmer/Systems Analyst  
3 ☐ Administration/Management  
4 ☐ Sales/Marketing  
5 ☐ Engineer/Scientist  
6 ☐ Other

B. What is your level of management responsibility?

- 7 ☐ Senior-level 9 ☐ Professional  
8 ☐ Middle-level

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?

- 10 ☐ Yes 11 ☐ No

D. What operating systems are you currently using? (Check all that apply)

- 12 ☐ PCMS-DOS 15 ☐ Unix  
13 ☐ DOS + Windows 16 ☐ MacOS  
14 ☐ OS/2 17 ☐ VAX/VMS

E. For how many people do you influence the purchase of hardware or software?

- 18 ☐ 1-25 20 ☐ 51-99  
19 ☐ 26-50 21 ☐ 100 or more

October 1992

90 96 99

Product Category	Information	Disks & Optical Drives	7	Multimedia	19	Educational	30	Shareware	42
		Diskettes/Duplicators	8	Printers/Plotters	20	Engineering/Scientific	31	Software Duplication	43
		Fax Boards/Machines	9	Programmable Hardware	21	Entertainment	32	Spreadsheets	44
		Graphics Tablets/Mice/		Scanners/OCR/Digitizers	22	Graphics	33	Unix	45
		Pen Input	10	Tape Drives	23	Macintosh	34	Utilities	46
		Keyboards	11	UPS	24	Mail Order	35	Windows	47
		LAN Hardware	12	Software		Mathematical/Statistical	36	Word Processing	48
		Laptops & Notebooks	13	Business	25	Miscellaneous Software	37	General	
		Mail Order	14	CAD/CAM	26	On-Line Services	38	Books/Publications	49
		Memory/Chips/Upgrades	15	Communications/Networking	27	Operating Systems	39	Recruitment	50
		Miscellaneous Hardware	16	Data Acquisition	28	Programming Languages/	40	Miscellaneous	51
		Modems/Multiplexors	17	Database	29	Tools	41		
		Monitors & Terminals	18			Security			

## Inquiry Numbers 52-233

52	78	104	130	156	182	208
53	79	105	131	157	183	209
54	80	106	132	158	184	210
55	81	107	133	159	185	211
56	82	108	134	160	186	212
57	83	109	135	161	187	213
58	84	110	136	162	188	214
59	85	111	137	163	189	215
60	86	112	138	164	190	216
61	87	113	139	165	191	217
62	88	114	140	166	192	218
63	89	115	141	167	193	219
64	90	116	142	168	194	220
65	91	117	143	169	195	221
66	92	118	144	170	196	222
67	93	119	145	171	197	223
68	94	120	146	172	198	224
69	95	121	147	173	199	225
70	96	122	148	174	200	226
71	97	123	149	175	201	227
72	98	124	150	176	202	228
73	99	125	151	177	203	229
74	100	126	152	178	204	230
75	101	127	153	179	205	231
76	102	128	154	180	206	232
77	103	129	155	181	207	233

## Inquiry Numbers 409-590

409	435	461	487	513	539	565
410	436	462	488	514	540	566
411	437	463	489	515	541	567
412	438	464	490	516	542	568
413	439	465	491	517	543	569
414	440	466	492	518	544	570
415	441	467	493	519	545	571
416	442	468	494	520	546	572
417	443	469	495	521	547	573
418	444	470	496	522	548	574
419	445	471	497	523	549	575
420	446	472	498	524	550	576
421	447	473	499	525	551	577
422	448	474	500	526	552	578
423	449	475	501	527	553	579
424	450	476	502	528	554	580
425	451	477	503	529	555	581
426	452	478	504	530	556	582
427	453	479	505	531	557	583
428	454	480	506	532	558	584
429	455	481	507	533	559	585
430	456	482	508	534	560	586
431	457	483	509	535	561	587
432	458	484	510	536	562	588
433	459	485	511	537	563	589
434	460	486	512	538	564	590

## Inquiry Numbers 766-947

766	792	818	844	870	896	922
767	793	819	845	871	897	923
768	794	820	846	872	898	924
769	795	821	847	873	899	925
770	796	822	848	874	900	926
771	797	823	849	875	901	927
772	798	824	850	876	902	928
773	799	825	851	877	903	929
774	800	826	852	878	904	930
775	801	827	853	879	905	931
776	802	828	854	880	906	932
777	803	829	855	881	907	933
778	804	830	856	882	908	934
779	805	831	857	883	909	935
780	806	832	858	884	910	936
781	807	833	859	885	911	937
782	808	834	860	886	912	938
783	809	835	861	887	913	939
784	810	836	862	888	914	940
785	811	837	863	889	915	941
786	812	838	864	890	916	942
787	813	839	865	891	917	943
788	814	840	866	892	918	944
789	815	841	867	893	919	945
790	816	842	868	894	920	946
791	817	843	869	895	921	947

## Inquiry Numbers 1123-1304

1123	1149	1175	1201	1227	1253	1279
1124	1150	1176	1202	1228	1254	1280
1125	1151	1177	1203	1229	1255	1281
1126	1152	1178	1204	1230	1256	1282
1127	1153	1179	1205	1231	1257	1283
1128	1154	1180	1206	1232	1258	1284
1129	1155	1181	1207	1233	1259	1285
1130	1156	1182	1208	1234	1260	1286
1131	1157	1183	1209	1235	1261	1287
1132	1158	1184	1210	1236	1262	1288
1133	1159	1185	1211	1237	1263	1289
1134	1160	1186	1212	1238	1264	1290
1135	1161	1187	1213	1239	1265	1291
1136	1162	1188	1214	1240	1266	1292
1137	1163	1189	1215	1241	1267	1293
1138	1164	1190	1216	1242	1268	1294
1139	1165	1191	1217	1243	1269	1295
1140	1166	1192	1218	1244	1270	1296
1141	1167	1193	1219	1245	1271	1297
1142	1168	1194	1220	1246	1272	1298
1143	1169	1195	1221	1247	1273	1299
1144	1170	1196	1222	1248	1274	1300
1145	1171	1197	1223	1249	1275	1301
1146	1172	1198	1224	1250	1276	1302
1147	1173	1199	1225	1251	1277	1303
1148	1174	1200	1226	1252	1278	1304

## Inquiry Numbers 234-408

234	259	284	309	334	359	384
235	260	285	310	335	360	385
236	261	286	311	336	361	386
237	262	287	312	337	362	387
238	263	288	313	338	363	388
239	264	289	314	339	364	389
240	265	290	315	340	365	390
241	266	291	316	341	366	391
242	267	292	317	342	367	392
243	268	293	318	343	368	393
244	269	294	319	344	369	394
245	270	295	320	345	370	395
246	271	296	321	346	371	396
247	272	297	322	347	372	397
248	273	298	323	348	373	398
249	274	299	324	349	374	399
250	275	300	325	350	375	400
251	276	301	326	351	376	401
252	277	302	327	352	377	402
253	278	303	328	353	378	403
254	279	304	329	354	379	404
255	280	305	330	355	380	405
256	281	306	331	356	381	406
257	282	307	332	357	382	407
258	283	308	333	358	383	408

## Inquiry Numbers 591-765

591	616	641	666	691	716	741
592	617	642	667	692	717	742
593	618	643	668	693	718	743
594	619	644	669	694	719	744
595	620	645	670	695	720	745
596	621	646	671	696	721	746
597	622	647	672	697	722	747
598	623	648	673	698	723	748
599	624	649	674	699	724	749
600	625	650	675	700	725	750
601	626	651	676	701	726	751
602	627	652	677	702	727	752
603	628	653	678	703	728	753
604	629	654	679	704	729	754
605	630	655	680	705	730	755
606	631	656	681	706	731	756
607	632	657	682	707	732	757
608	633	658	683	708	733	758
609	634	659	684	709	734	759
610	635	660	685	710	735	760
611	636	661	686	711	736	761
612	637	662	687	712	737	762
613	638	663	688	713	738	763
614	639	664	689	714	739	764
615	640	665	690	715	740	765

## Inquiry Numbers 948-1122

948	973	998	1023	1048	1073	1098
949	974	999	1024	1049	1074	1099
950	975	1000	1025	1050	1075	1100
951	976	1001	1026	1051	1076	1101
952	977	1002	1027	1052	1077	1102
953	978	1003	1028	1053	1078	1103
954	979	1004	1029	1054	1079	1104
955	980	1005	1030	1055	1080	1105
956	981	1006	1031	1056	1081	1106
957	982	1007	1032	1057	1082	1107
958	983	1008	1033	1058	1083	1108
959	984	1009	1034	1059	1084	1109
960	985	1010	1035	1060	1085	1110
961	986	1011	1036	1061	1086	1111
962	987	1012	1037	1062	1087	1112
963	988	1013	1038	1063	1088	1113
964	989	1014	1039	1064	1089	1114
965	990	1015	1040	1065	1090	1115
966	991	1016	1041	1066	1091	1116
967	992	1017	1042	1067	1092	1117
968	993	1018	1043	1068	1093	1118
969	994	1019	1044	1069	1094	1119
970	995	1020	1045	1070	1095	1120
971	996	1021	1046	1071	1096	1121
972	997	1022	1047	1072	1097	1122



# YOUR DIRECT LINK CARD

**For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!**

See reverse side for card.

## 1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

## 2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

## 3. Product information will be rushed to you from the selected companies!

# BYTE

TNT MAILFAST

FRG/BOS/700252/MO1

P.O. Box 66

Hounslow

TW5 9RT

England

PLACE  
POSTAGE  
HERE



**BYTE** magazine



# YOUR DIRECT LINK CARD

For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

Yes, I want **FREE** information on the following products!

Fill out this coupon carefully. Please Print.

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Country \_\_\_\_\_ Code \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

A. What is your primary job function/principal area of responsibility? (Check one)

- 1 ☐ MIS/DIP  
2 ☐ Programmer/Systems Analyst  
3 ☐ Administration/Management  
4 ☐ Sales/Marketing  
5 ☐ Engineer/Scientist  
6 ☐ Other

B. What is your level of management responsibility?

- 7 ☐ Senior-level 9 ☐ Professional  
8 ☐ Middle-level

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?

- 10 ☐ Yes 11 ☐ No

D. What operating systems are you currently using? (Check all that apply)

- 12 ☐ PC/MS-DOS 15 ☐ Unix  
13 ☐ DOS + Windows 16 ☐ MacOS  
14 ☐ OS/2 17 ☐ VAX/VMS

E. For how many people do you influence the purchase of hardware or software?

- 18 ☐ 1-25 20 ☐ 51-99  
19 ☐ 26-50 21 ☐ 100 or more

October 1992

90 96 99

<b>Product Category Information</b>		Disks & Optical Drives	7	Multimedia	19	Educational	30	Shareware	42
Circle the numbers below for information on the entire category or products you're interested in.		Diskettes/Duplicators	8	Printers/Plotters	20	Engineering/Scientific	31	Software Duplication	43
		Fax Boards/Machines	9	Programmable Hardware	21	Entertainment	32	Spreadsheets	44
		Graphics Tablets/Mice/		Scanners/OCR/Digitizers	22	Graphics	33	Unix	45
		Pen Input	10	Tape Drives	23	Macintosh	34	Utilities	46
<b>Hardware</b>		Keyboards	11	UPS	24	Mail Order	35	Windows	47
Accessories/Supplies	1	LAN Hardware	12	<b>Software</b>		Mathematical/Statistical	36	Word Processing	48
Add-in Boards	2	Laptops & Notebooks	13	Business	25	Miscellaneous Software	37	<b>General</b>	
Bar Coding	3	Mail Order	14	CAD/CAM	26	On-Line Services	38	Books/Publications	49
Communications/Networking	4	Memory/Chips/Upgrades	15	Communications/Networking	27	Operating Systems	39	Recruitment	50
Computer Systems	5	Miscellaneous Hardware	16	Data Acquisition	28	Programming Languages/		Miscellaneous	51
Data Acquisition	6	Modems/Multiplexors	17	Database	29	Tools	40		
		Monitors & Terminals	18			Security	41		



# YOUR DIRECT LINK CARD

**For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!**

See reverse side for card.

## 1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

## 2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

**3. Product information will be rushed to you from the selected companies!**

# BYTE

TNT MAILFAST

FRG/BOS/700252/MO1

P.O. Box 66

Hounslow

TW5 9RT

England

PLACE  
POSTAGE  
HERE



# BYTE



# YOUR DIRECT LINK

## PRODUCT CATEGORY INDEX

For **FREE** product information from individual advertisers, circle the corresponding inquiry numbers on your Direct Link Card!

To receive information for an entire product category, circle the category number on your Direct Link Card!

Category No. Inquiry No.	Page No.	Category No. Inquiry No.	Page No.	Category No. Inquiry No.	Page No.
296 XELTEK	329	173 STRATEGIC MAPPING	240	190 WATCOM PRODUCTS INC	27
297 Z-WORLD ENGINEERING	329	178-179 SYSTAT INC	109	191 WATCOM PRODUCTS INC	75
<b>22 SCANNERS/OCR/DIGITIZERS</b>		<b>32 ENTERTAINMENT</b>		<b>41 SECURITY</b>	
339 COMPUTER TELECOMMUNICATIONS	234UK-2	207 BROWN WAGH PUBLISHING	226	366 ALADDIN KNOWLEDGE SYSTEMS	6
334-355 KYE SYSTEMS CORP	194IS-5	241 MICROPROSE SOFTWARE	301	63 ALADDIN KNOWLEDGE SYSTEMS	61
<b>23 TAPE DRIVES</b>		* REASONABLE SOLUTIONS	136IS-5-6	425 ALADDIN KNOWLEDGE SYSTEMS	314NE-4
68-69 AMERICAN MEGATRENDS	107	332 WESTPOINT CREATIVE	186UK-3	426 ALADDIN KNOWLEDGE SYSTEMS	314NE-5
83-84 COLORADO MEMORY SYSTEMS	85	<b>33 GRAPHICS</b>		382 EUTRON	250IS-2
378-379 CORE INTERNATIONAL	100	207 BROWN WAGH PUBLISHING	226	383 FAST ELECTRONIC GMBH	166IS-3
278 LAGUNA DATA SYSTEMS	329	92 COREL SOFTWARE	46	108-109 GLENCO ENGINEERING	207
284 OVERLAND DATA INC	329	* FRAME TECHNOLOGY	153-154	127-128 MICRONET TECHNOLOGY	197
212 PARALLEL PERIPHERALS	209	103 FRAME TECHNOLOGY	155	159-160 RAINBOW TECHNOLOGIES	113
288 QUALSTAR CORP	329	134-135 NANAUSA CORP	104-105	157-158 RAINBOW TECHNOLOGIES	160
328 VOGON ENTERPRISES LTD	226UK-3	300 OSCS	332	165-166 SOFTWARE SECURITY INC	253
<b>24 UPS</b>		* PACIFIC DATA PRODUCTS	88-89	224-226 VILLA CRESPO SOFTWARE LTD	135
70 AMERICAN POWER CONVERSION	218	285 PATTON & PATTON	330	<b>42 SHAREWARE</b>	
231-232 BAY TECHNICAL ASSOC	309	340 R.E.M.	226UK-2	327 DATASTORM TECHNOLOGIES	234UK-4
339 COMPUTER TELECOMMUNICATIONS	234UK-2	180 TEKTRONIX	193	* REASONABLE SOLUTIONS	136IS-5-6
140 MINUTEMAN	117	<b>34 MACINTOSH</b>		<b>44 SPREADSHEETS</b>	
141-142 PC POWER & COOLING	103	117-119 INTERGRAPH (N.A.)	248	367-368 BORLAND INTERNATIONAL	CIV
183-184 TRIPP LITE	114	418-419 KINGLI TECHNOLOGY, INC	314MW-6	76-77 BORLAND INTERNATIONAL	11-15, 17
		431-432 KINGLI TECHNOLOGY, INC	314NE-4	89 COMPUTER ASSOCIATES	39
		178-179 SYSTAT INC	109	<b>45 UNIX</b>	
<b>SOFTWARE</b>		<b>35 MAIL ORDER</b>		336 CORPORATE HI TECH SERVICES	186UK-2
<b>25 BUSINESS</b>		233 BULLDOG COMPUTER PRODUCTS	288	111 HUMMINGBIRD COMMUNICATIONS	261
329 BLACKWELL SOFTWARE	226UK-1	87 COMPUCLASSICS	264	117-119 INTERGRAPH (N.A.)	248
79 CALERA RECOGNITION SYS	112	374 COMPUFAVE INTERNATIONAL	178IS-2	* MARK WILLIAMS CO	119
91 COMPUTER ASSOCIATES	97	377 COMPUTER QUICK	168IS-2	391 MORTICE KERN (MKS)	136IS-4
100 DIGITAL RESEARCH INC (N.A.)	191	* GREY MATTER LTD	274IS-1	209 STRUCTURED SOFTWARE SOLUTIONS	274IS-3
221 FUNK SOFTWARE	91	124 PROGRAMMER'S PARADISE	66-67	SUNSOFT	2-3
338 INST OF ANALYSTS & PROGRAMMERS	186UK-2	* PROGRAMMER'S PARADISE	80A-B	<b>46 UTILITIES</b>	
161 SZKI RECOGNITA CORP	133	* PROGRAMMER'S SHOP (N.A.)	80-83	370-371 CLARION SOFTWARE	166IS-4
<b>26 CAD/CAM</b>		164 S'NW ELECTRONICS	272	375 COBALT BLUE	178IS-3
71 AMERICAN SMALL BUSINESS COMP	55	* SOFTLINE CORP	136IS-2	176-177 LANDMARK RESEARCH INTL CORP	131
106-107 AUTODESK RETAIL PRODUCTS	262	322 SURPLUS SOFTWARE INTL	330	305 MICRO HOUSE	332
127-128 EVOLUTION COMPUTING	314NE-3	<b>36 MATHEMATICAL/STATISTICAL</b>		300 OSCS	332
134-135 EVOLUTION COMPUTING	314PC-1	102 DSP DEVELOPMENT CORP	177	150 PKWARE INC	260
17-119 INTERGRAPH (N.A.)	248	334 NAG	186UK-4	172 STORAGE DIMENSIONS	194
340 R.E.M.	226UK-2	289 SAS INSTITUTE INC	331	* VERMONT CREATIVE SOFTWARE	21
<b>27 COMMUNICATIONS/NETWORKING</b>		170-171 STATSOFT	139	328 VOGON ENTERPRISES LTD	226UK-3
208 CASTELLE CORP	49	<b>37 MISCELLANEOUS SOFTWARE</b>		<b>47 WINDOWS</b>	
136 CORPORATE HI TECH SERVICES	186UK-2	79 CALERA RECOGNITION SYS	112	79 CALERA RECOGNITION SYS	112
237 DATASTORM TECHNOLOGIES	234UK-4	411 ON TIME MKT/KARSTEN PETERSEN	178IS-3	325 DIGITAL SOUP INC	332
168 DIVERSIFIED COMPUTER	329	173 STRATEGIC MAPPING	240	111 HUMMINGBIRD COMMUNICATIONS	261
99 FUNK SOFTWARE	91	161 SZKI RECOGNITA CORP	133	335 ICONOGRAPHIC SYSTEMS	186UK-2
100 MINICOM LTD	178IS-3	<b>38 ON-LINE SERVICES</b>		121 KEA SYSTEMS LTD	106
45 OSCS	332	* AMERICA ONLINE INC	178A-B	* MICROSOFT CORP	188-189
45 PERSOFT INC	238	450 BIX	347	134-135 NANAUSA CORP	104-105
136IS-5-6 ULTIMATE TECHNOLOGY	250IS-1	88 COMPUERVE	120-121	205 NETWORK COMPUTING DEVICES	183
08 WALKER, RICHER & QUINN		<b>39 OPERATING SYSTEMS</b>		145 PERSOFT INC	238
<b>28 DATA ACQUISITION</b>		336 CORPORATE ITEC SERVICES	186UK-2	337 QUIN SYSTEMS LTD	234UK-1
37 NATIONAL INSTRUMENTS	136IS-5-6	100 DIGITAL RESEARCH INC (N.A.)	191	REASONABLE SOLUTIONS	136IS-5-6
QUIN SYSTEMS LTD	234UK-1	* MARK WILLIAMS CO	119	SYSTEMSTAR	234UK-3
<b>29 DATABASE</b>		154 QUARTERDECK OFFICE SYSTEMS	185	224-226 VILLA CRESPO SOFTWARE LTD	135
06 BLINK INC	217	<b>40 PROGRAMMING LANGUAGES/TOOLS</b>		192-193 XVT SOFTWARE INC	156
0 COMPUTER ASSOCIATES	148	222-223 CASE DESIGN INTERNATIONAL	35	196 ZYLAB/DIVISION OF IDI	244
06 MAGIC/MSE (INTL)	178IS-4	375 COBALT BLUE	178IS-3	<b>48 WORD PROCESSING/DTP</b>	
56 MICROSOFT CORP	8-9	93-94 DATA ACCESS CORP	145	269 GLOBALINK INC	332
63 RAIMA CORP	87	100 DIGITAL RESEARCH INC (N.A.)	191	392 OXFORD ELECTRONIC PUBLISHING	274IS-3
73 SEQUITER SOFTWARE INC	225	99 DIGITALINK INC	245	* PACIFIC DATA PRODUCTS	88-89
73 STRATEGIC MAPPING	240	104-105 FTP SOFTWARE (N.A.)	6	333 SYSTEMSTAR	234UK-3
96 ZYLAB/DIVISION OF IDI	244	271 GREENLEAF SOFTWARE	331	194 WORDPERFECT CORP	31
<b>30 EDUCATIONAL</b>		385 GREY MATTER LTD	274IS-1	196 ZYLAB/DIVISION OF IDI	244
1-62 ABACUS SOFTWARE	143	338 INST OF ANALYSTS & PROGRAMMERS	186UK-2	<b>GENERAL</b>	
AME INSTIT FOR COMP SCIENCES	330	311 IVERSON SOFTWARE, INC	331	<b>49 BOOKS/PUBLICATIONS</b>	
MCGRAW HILL NRI (N.A.)	194A-B	122 LAHEY COMPUTER SYSTEMS	116	321 HARPER COLLINS	329
<b>31 ENGINEERING/SCIENTIFIC</b>		201-202 LIANT SOFTWARE CORP (INTL)	273	220 M-H INTERAMERICA DE MEXICO	270
74 APL * PLUS/MANUGISTICS INC	165	199-200 LIANT SOFTWARE CORP (N.A.)	273	* MICROSOFT PRESS INC	102
2-73 ARC SOFTWARE	116	386 MAGIC/MSE (INTL)	178IS-4	* UNIXWORLD	243
32 DSP DEVELOPMENT CORP	177	390 MIX SOFTWARE	266IS-4	* UNIXWORLD	242A-B
37 GRAMMAR ENGINE, INC	330	334 NAG	186UK-4	<b>50 RECRUITMENT</b>	
76-177 LANDMARK RESEARCH INTL CORP	131	313 OMEGA POINT, INC	331	338 INST OF ANALYSTS & PROGRAMMERS	186UK-2
25 MATHSOFT INC	229	411 ON TIME MKT/KARSTEN PETERSEN	178IS-3	<b>51 MISCELLANEOUS</b>	
26 MATHSOFT INC	250	143-144 PERISCOPE COMPANY, THE	174	* BYTE REPRINTS	244
34 NAG	186UK-4	146 PHAR LAP SOFTWARE INC	43	* BYTE SUB MESSAGE	156
11 ON TIME MKT/KARSTEN PETERSEN	178IS-3	* PROGRAMMER'S SHOP (N.A.)	80-83	DEXPO/MILLER FREEMAN, INC	314PC-3
38 SPECTRUM SOFTWARE (N.A.)	187	151-152 PROGRESS SOFTWARE	173		
59 SPSS INC	141	287 PSEUDOCORP	331		
70-171 STATSOFT	139	159-160 RAINBOW TECHNOLOGIES	113		
		157-158 RAINBOW TECHNOLOGIES	160		
		446 STATGRAPHICS / MANUGISTICS INC	222		
		185 TURBOPOWER SOFTWARE	269		



# EDITORIAL INDEX

For more information on any of the companies covered in articles, columns, or news stories in this issue, circle the appropriate inquiry number on Your Direct Link Card. Each page number refers to the first page of the article or section in which the company name appears.

Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.			
<b>A</b>				<b>R</b>						
1183	Abraxas Software	195	1225	Dell Computer	26, 212, 227, 235	1227	Radius	242		
1205	Absoft	195	1235			1012	Raima	195		
1230	Acer America	212	1187	DeScribe	195	1197	Rainbow Technologies	195		
	Acorn	26	1159	Digitaltalk	86, 277	1334	Relax Technology	198		
1206	Acucobol	195	1302			1198	Revelation Technologies	195		
1222	Adaptec	198, 254	1315	Digital Optics	96	<b>S</b>				
1320			1213	Digital Tools	195	The Santa Cruz Operation			179	
1184	Adobe Systems	195, 223		Disclosure	256	Safari Systems			118	
1231	Advanced Logic Research	212	1321	Disctec	198	SGS-Thomson			26	
	The AG Group	78		DuPont Pixel	26	Sharp			47	
1311	Aldus	96	<b>E</b>			Silicon Graphics			26, 179	
	Altai	26	1030	Easel	195	Smith Corona			69	
1207	Always Technology	69, 195		Echo Logic	179	Soft & GUI			277	
1280			1291	EFI Electronics	78	Softtronics			195	
1020	Amish Software	195		Elonex	122	Software AG			195	
1056	Amstrad	58	1160	Enfin Software	195, 277	Software Engineering			277	
1282	Aox	70	1188			Software Publishing			195	
1059	Apple Computer	26, 52, 118, 122,	1214	Enhanced Software	195	Software Ventures			195	
1150		149, 179, 242	1322	Epson America	58, 198	Softworks			195	
1226				Etnoteam	26	Solaris			235	
1208	Applix	195	1236	Everex Systems	212	Sony			198	
1021	Arbor Software	195		Excel	223	SourceLine Software			277	
1155	Arity	277	1295	Extended Systems	78	Star-Tek			195	
1232	AST Research	212	<b>F</b>			The Stirling Group			277	
	AT&T	26, 118, 149, 275	1310	F-Chart Software	94	SunConnect			179	
	Atari	58, 149	1281	50/50 Micro Electronics	70	Sybase			195	
	ATI Technologies	122	1070	Frame Technology	195, 247	SyDOS			198	
1022	Autodesk	195	1215			Symantec			195	
1023	Automated Methods	195	1032	FranklinQuest	118, 195	Synaptics			137	
1298	Avalan Technology	84	1146			Syntha-Voice Computers			96	
	Avid Technology	26		Fujitsu	47	Sysgen			198	
<b>B</b>				1033	Future Soft Engineering	195	<b>T</b>			
1185	Banyan Systems	195	<b>G</b>			Tandon			251	
	Bear Stearns	26	1309	Gage Applied Sciences	94	Tandy			26	
	Berkeley Software Design	26	1161	Gamma Tech	277	Tangent Computer			212	
1294	Best Data Products	78	1237	Gateway 2000	122, 212, 282	Texas Instruments			118	
	Beta Phase	122	1285	Genoa Systems	70, 122	Thomson Components			26	
	Binar Graphics	122	1162	Gpf Systems	277	Thoroughbred Software			195	
1313	Black Ice Software	96	1216	Great Plains Software	195	International			195	
1283	Blue Chip Technology	70	1163	Guidance Technologies	277	Titan Application			195	
1301	Blue Sky Software	86	1034	Guild Products	195, 277	Toshiba			118, 227	
	BNN Laboratories	149	1164			Trantor Systems			198	
1156	Borland International	26	1217	Gupta Technologies	195	<b>U</b>				
1186		179, 195, 277	<b>H</b>			Unify			195	
1149	The BSE Co.	118	1035	Hamilton Laboratories	195, 277	Unison Information Systems			69	
<b>C</b>				1165		UniStor			69	
1209	Cadre Technologies	195		Harvard Graphics	223	Unisys			179	
1318	CAF Technology	68	1058	Hewlett-Packard	26, 58, 179,	United Technologies			26	
1223	Canon	158, 233	1224		223, 233, 275	Univel			158, 179	
1304	Cardiff Software	86	1036	Hilgraeve	195	Unix Systems			26, 179	
1157	Caseworks	277	1037	Horizon Technology	195	<b>L</b>				
	Chantal Systems	259	1218	Hyperdesk	195	Legato Systems			195	
	Chips & Technologies	122	<b>I</b>			Lernout & Hauspie			26	
1158	Clarion Software	277	1238	IBM	26, 58, 122, 149, 158,	Liant Software			195, 277	
1055	Claris	58			179, 212, 251, 259	Locus Computing			179	
1210	Clarity Software	195	1038	Image-In	195	Logitech			58, 227	
1211	Cleo Communications	195	1323	Image Network Technology	198	Lotus Development			26, 90, 179,	
1271	Clover Computer Systems	68	1166	ImageSoft	277	1305			195, 223, 251, 348	
1275	Colorado Memory Systems	69	1189	Imara Research	195	1190			Lucas Management Systems	195
1229	Compaq Computer	26, 122, 167,	1039	Inference	195	<b>M</b>				
1233		212, 227, 282	1219	Infopro	195	Mass Memory Systems			198	
	Compudyne Products	122	1220	Information Builders	195	McDonnell Douglas			118	
	CompuServe	149	1000	Informix Software	195	MCI			149	
	Computer Associates		1001	Ingres	195	Microfield Graphics			195	
1024	Computervision	195		Insomnia Solutions	167, 179	Micro Focus			277	
1212	Control	195		Integra Technologies	259	Micrografix			118, 179, 195, 277	
	Core International	259	1002	Integrated Computer	195	<b>M</b>				
1025	Corel Systems	118, 195,		Solutions		MicroQuill Software				
1147		198, 223, 254		Intel	26, 47, 122, 158,	Publishing			118	
1221					167, 179, 235	Microsoft			26, 47, 158, 167,	
1228			1167	Intelligent Environments	277				179, 195, 223	
1339			1286	Intelligent Security	74	Microsoft Press			256	
1026	Coromandel Industries	195	1040	Intellisoft	195	MicroSolutions			198	
1027	Crystal Point	195	1041	Interleaf	195	Microtech International			198	
	Cyrix	26, 251	1168	Intersolv	277	MicroWay			195, 277	
<b>D</b>					Intuit	26	<b>N</b>			
	D.W. Electrochemicals	282	1324	Iomega	198	National Semiconductor			122	
1028	Data Access	195	1306	IQ Software	90	NCR			118, 179, 212	
1300	Data Spec	84	1003	Island Graphics	195	NEC Technologies			78	
1272	DataBusiness Systems	68	<b>K</b>			NetCom			149	
1029	DEC	26, 149, 158,	1287	KK Systems	74	NetLabs			195	
1234		179, 195, 212	1153	Knowledge Adventure	118	Netmanage			195	
<b>R</b>						Neuron Data			195	
1227	Radius	242				New Era Microsystems			84	
1012	Raima	195				New World Computing			118	
1197	Rainbow Technologies	195				Next			26, 149, 179	
1334	Relax Technology	198				Northgate Computer				
1198	Revelation Technologies	195				Systems			212, 282	
<b>S</b>						1193			Novell	149, 179, 195, 259
The Santa Cruz Operation				179					Nth Graphics	26
1152	Safari Systems	118				<b>O</b>				
	SGS-Thomson	26				Object Design			195	
	Sharp	47				Ocean Microsystems			198	
	Silicon Graphics	26, 179				Olivetti			179	
1276	Smith Corona	69				Omron Office Automation				
1176	Soft & GUI	277				Products			78	
1199	Softtronics	195				Oracle			195	
1013	Software AG	195				1317			Outokumpu Research	94
1177	Software Engineering	277				<b>P</b>				
1046	Software Publishing	195				Pacific Data Products			58	
1047	Software Ventures	195				Panasonic Communications				
1014	Softworks	195				& Systems			198	
	Solaris	235				Parallel PC's			277	
1335	Sony	198				Peachpit Press			118	
1178	SourceLine Software	277				Peachtree Software			90	
1200	Star-Tek	195				1316			Pegasus Software	90
1179	The Stirling Group	277				1330			Peripheral Land	198
	SunConnect	179				1045			The Periscope Co.	195, 277
1201	Sybase	195				1174				
1336	SyDOS	198				1175			Personal Systems Software	277
1048	Symantec	195				1331			Pinnacle Micro	198
	Synaptics	137				1290			Primax Electronic	74
1314	Syntha-Voice Computers	96				1332			Procom Technology	198
1337	Sysgen	198				1011			Progress Software	195
<b>T</b>						1195			Project Management	195
1608	Tandon	251				1296			Prometheus Products	84
	Tandy	26				1279			ProTégé	69
1241	Tangent Computer	212				<b>Q</b>				
	Texas Instruments	118				Quantum			198	
	Thomson Components	26				1196			Quantum Development	195
1015	Thoroughbred Software	195				1312			Quicksoft	96
	International	195							Quorum Software Systems	26
1049	Titan Application	195								
	Toshiba	118, 227								
1338	Trantor Systems	198								
<b>U</b>										
1016	Unify	195								
1277	Unison Information Systems	69								
1278	UniStor	69								
	Unisys	179								
	United Technologies	26								
	Univel	158, 179								
	Unix Systems	26, 179								
	Laboratories									
<b>V</b>										
1202	Vienna Software	195								
1288	Visage	74								
1284	Visionetics International	70								
1050	VisiSoft	195								
1274	Visual	68								
1180	Vleermuis Software	277								
1017	Voxem	195								
1181	VZ	277								
<b>W</b>										
1051	Wall Data	195								
1182	Watcom	195, 277								
1203										
1052	Wolfram Research	195								
1018	WordPerfect	195								
<b>X</b>										
1053	XBD Systems	195								
1019	Xtree	195								
1303	XVT Software	86								
	XyQuest	179								
<b>Y</b>										
	Yarc Systems	122								
<b>Z</b>										
1151	Zenith Data Systems	118								
1609	Zeos International	251								
1204	ZSoft	195, 223								



# Decisions, decisions, decisions.

## Decider, decider, decider.

on-sizing, upgrading, multi-platform environments. Today's computer hardware issues are numerous, more difficult, more critical than ever. So how do companies make decisions?

According to a new IntelliQuest study, they turn to the only person qualified to decide. Some-  
times like Bob Barrett. A person with 18 years in computers. Who oversees a technical staff of 75. Whose buying decisions and approvals affect more than 3,000 users worldwide.

In other words, they turn to the BYTE reader. All 92% of whom control the products and services their companies buy.

If you want to reach an audience as influential as this, then yours is an easy decision—advertise in BYTE.

Reader Robert N. Barrett, Vice President Management Information Systems, M/A-COM, Inc.

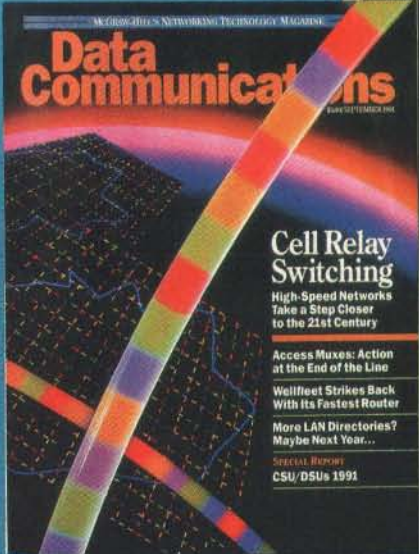
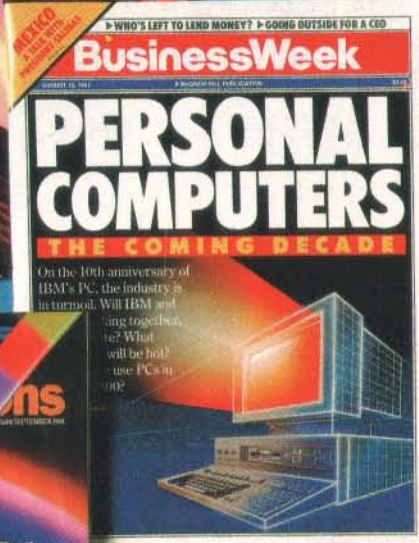
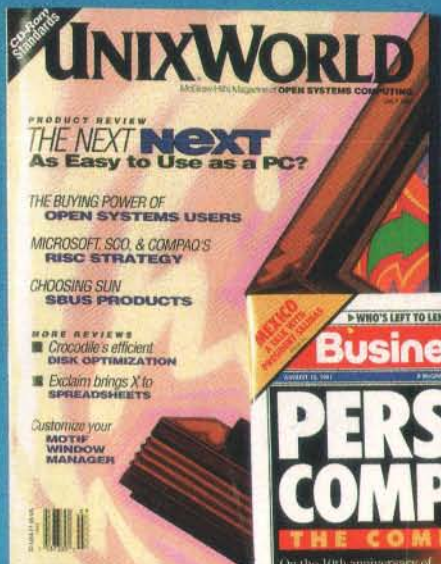
### It doesn't get bought without





# Your network buy for today's business technology market.

## McGraw-Hill TechNet



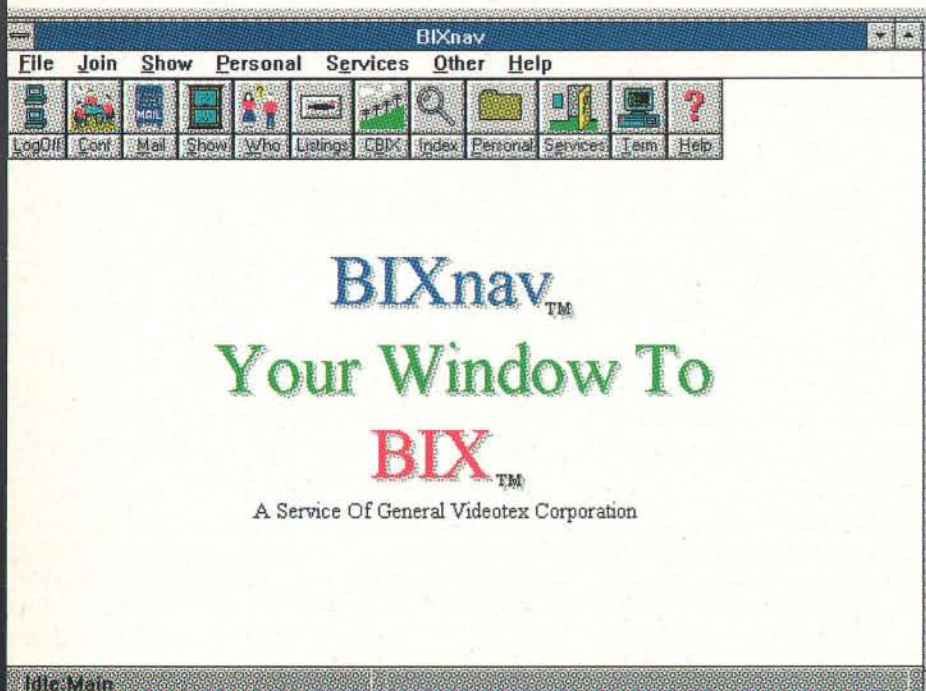
## McGraw-Hill Magazines. Your Best Business Partners.

- 4— Architectural Record ■ 7— A/C Flyer, Aviation Week & Space Technology, AW & ST China Quarterly, AW & ST USSR, Business & Commercial Aviation, World Aviation Directory and Buyer's Guide ■ 20— Business Week, Business Week China, Business Week Hungary, Business Week International, Business Week USSR
- 28— Chemical Engineering ■ 32C— BYTE, Data Communications, Data Communications International, LAN Times, UnixWorld ■ 39— Electrical World ■ 41— ENR, Construction News Publishing Network (11 magazines, 4 newspapers) ■ 46— Global Finance ■ H6— The Physician & Sportsmedicine, Postgraduate Medicine
- 114— Modern Plastics, Modern Plastics International ■ 117— Power, Power International





# Introducing BIXnav



- Software Libraries
- Background Downloading
- Powerful Search Feature
- Hypertext to file downloads, mail addressing, and user information

## A WINDOWS NAVIGATOR FOR BIX

### BIX Covers Computing Right!

Not only does BIX have great information, now it has a great user interface.

When you are up against a brick wall and need answers to tough programming questions fast, BIX has the solutions you need! Other online services cater to end users and computer neophytes. BIX serves computer pros like you! On BIX, you don't have to pan through mountains of trash to find the golden nuggets. You get fast answers from people who know computing.

BIX's Exchanges cover all aspects of computing in all platforms and computer languages. And BIXnav makes using BIX as easy as your other Windows applications.

### Lots of New Files

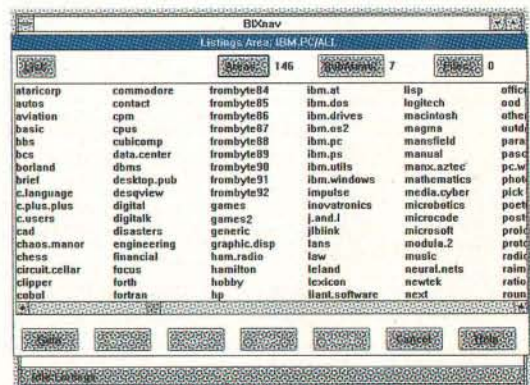
BIX publishes hundreds of new files each month. You can find files by date or keyword, and you can even download them in the background with a simple click.

### BIX is Affordable

Subscribe to BIX for only \$13 per month. Connect to BIX locally via Tymnet for only \$3 per hour.\* Or, choose the 20/20 Plan, where \$20 per month covers your first 20 hours of evening or weekend access. Additional time is only \$1.80 per hour on the 20/20 Plan.\* Once online, you can download BIXnav for only \$9.95.

### Join BIX Now!

Using any communications program, dial 1-800-695-4882. Enter "bix" at the prompt. When you are prompted for



"Name?" enter "bix.navigator" and complete the online registration. Pay by credit card for immediate access.

For additional information call  
1-800-695-4775 or 617-354-4137.

BIX is a service of  
General Videotex Corporation,  
1030 Massachusetts Avenue, 4th Floor,  
Cambridge, MA 02138.  
617-491-3342.

\*Rates listed apply for evening and weekend access from within the contiguous 48 states. Daytime access from within the contiguous 48 states is billed at \$9 per hour.



DANIEL  
SELIGMAN

## TRIVIAL PURSUITS

**Inventing new  
computing conundrums  
is an art in itself**

**E**very morning, I turn on my computer and note with satisfaction that once again it has spared me the task of calculating my age. Its opening shot: "Hello again. This is day no. [A] of your life. Think you can handle it (Y/N)?" (The bracketed A is a number, currently spiraling toward 25,000, that increases by one each day.) I touch the Y key, which puts me into XyWrite, and the day's word processing begins.

XyWrite? (Confession: It does that even if I hit the N key.) Shouldn't a doomsday mushroom cloud appear on the screen? Yes, it should, and work on this project continues.

Grown-ups are supposed to think of the PC as a piece of business equipment, and it certainly qualifies as one for us writers. But there is a class of users—I can't be the only one, can I?—for whom the PC is the greatest adult toy in history. I am not talking about folks who spend all day playing computer games, but about those like me who find computing itself to be fun and work hard at inventing problems to be solved.

Like asking the computer to print out all the possible sequences in which a chap can put on 11 items of clothing—shoes, socks, briefs, undershirt, shirt, tie, vest, jacket, pants, topcoat, and Stetson hat. (The correct answer to this one, assuming that the undershirt has to go on before the hat, and the pants before either the shoes or the topcoat: 5327.)

Or using BASIC to randomly seat dinner-party guests according to "legal" bourgeois rules, which forbid participants from sitting next to spouses or persons of their own sex. Or creating a program wherein the Lotus random-number generator throws up a twentieth-century date on the screen when you press F9, asks for the date's day of the week, checks the time it takes you to respond, and congratulates you if you type in the right answer.

A personal favorite was the six-card-draw problem. In a spirit of whimsy, our monthly poker game had adopted a special rule: Participants in draw poker had the option not only of drawing to two pairs and other improvable hands, but of throwing in all five cards and receiving six. We all knew that it was a suboptimal strategy, but occasionally someone ended up winning a sizable pot

doing it—and leaving us pondering the odds.

The odds at first proved elusive. Bugged down in confusion over the overlapping possibilities in sets of six cards (e.g., a set could include both a straight and a flush) I was ready to abandon my efforts to construct a probability distribution for such hands. Then I had a thought that caused my heart to leap. Why not attack the problem via a Monte Carlo simulation? This was the perfect solution for anyone with an underutilized toy and a working knowledge of BASIC.

The idea was to simulate the dealing of some large number of six-card sets, tell the computer how to classify each set, and note the relative probability of each kind of hand. The exercise was great fun, and after working with it for two months, I had my probabilities lined up. It was clear, for example, that in a six-card draw, there was almost one chance in two of getting one pair and one chance in 28 of getting three of a kind. But there was a maddening flaw in the program. When I ran a million trials and asked it to count occurrences of each kind of hand, the sum of the hands kept coming to a little less than a million—typically, 999,950 or so. Obviously, some kind of hand was being undercounted.

This problem arguably subtracted two articles from my 1991 writing output, but I finally solved it. I was not picking up all four-of-a-kind hands. My BASIC program had been instructed to think of four of a kind as any hand containing four identical values plus two separate values. But, of course, four identical values still count as four of a kind even if the fifth and six values are also identical, as in four jacks and a pair of sevens. Hands like this are rare—the probability is 0.000046, I was later told by a professor of statistics—but in a million deals, you run into some of them.

The findings of my corrected program were generously shared with the entire table. They did not noticeably affect anybody's play. But I still think the guy who did the work embodies a niche market. The question is about its size—and sanity. ■

*Daniel Seligman is a contributing editor for Fortune magazine. He also writes Fortune's Keeping Up column. You can reach him on BIX c/o "editors."*

*Stop Bit is a forum for informed opinion on personal computing topics. The opinions expressed are those of the author and not necessarily those of BYTE. Your contributions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.*



# CONTROL UP TO **96** PC FILE SERVERS WITH **1** KEYBOARD AND MONITOR USING...

## **COMMANDER**

by cybex

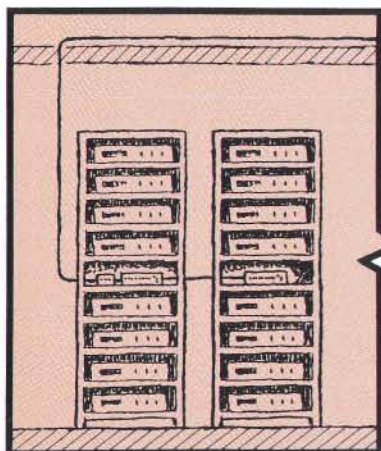
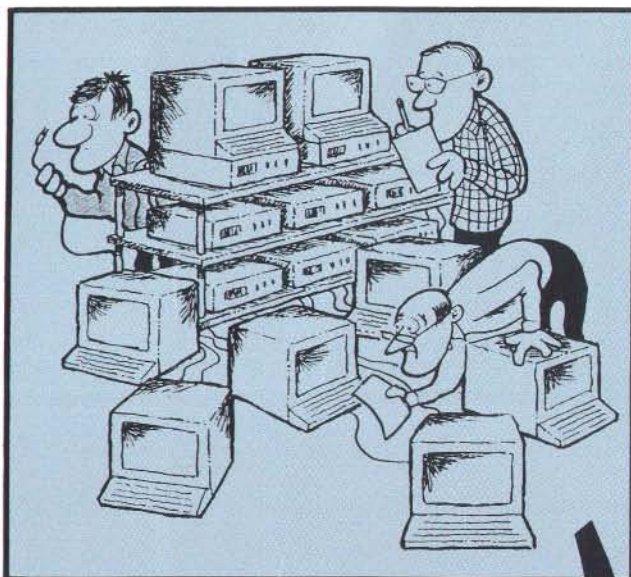
Keyboard  
Control

AutoBoot™

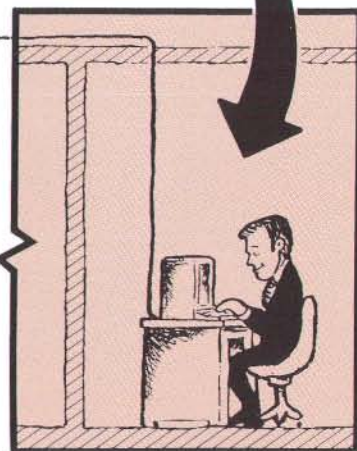
Dual  
Access



- **Select via Keyboard**
- **Dual access up to 250 feet away (optional)**
- **No external power**
- **Mix PC, PC/XT, PC/AT and PS/2**
- **"AutoBoot™" Feature boots attached computers without operator intervention**
- **Shows PC power status**



- **PS/2 Mouse support available**
- **Each unit accommodates from 2 to 8 PCs**
- **Up to 12 units can be cascaded**
- **Mounting kit available for 19" and 24" rack installation**



Dealer Program Available

**Cybex Corporation**

2800-H Bob Wallace Ave.  
Huntsville, Alabama 35805

**(205) 534-0011**

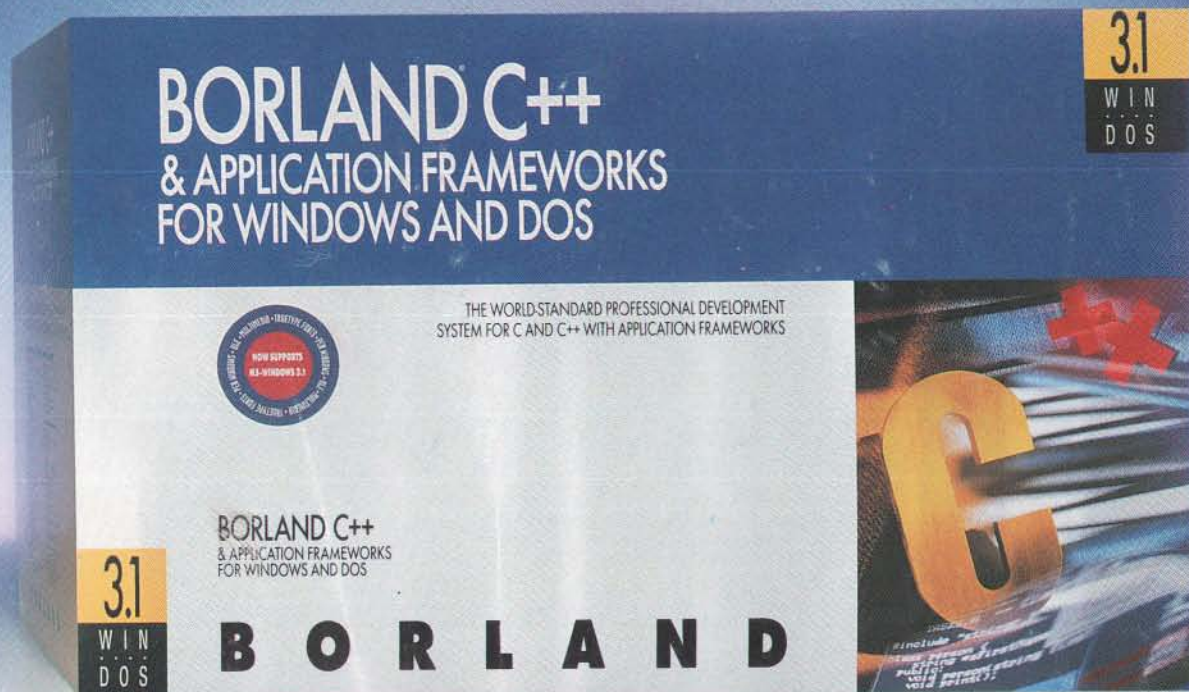
**Fax (205) 534-0010**

PC, PC/XT, PC/AT and PS/2 are trademarks of International Business Machines Corp.



**New!  
Version 3.1**

# Get the world standard professional development system



Professional programmers around the world are moving up to Borland® C++. With more than 700,000 C++ products shipped, Borland Language products have earned the trust of leading developers worldwide. Contact your local office to order.

**AUSTRALIA** 02-953 9500  
The world standard professional development system

**BELGIQUE/BELGIË** 02-4610 448  
Le standard mondial des systèmes de développement professionnels  
De wereldwijde standaard voor professionele ontwikkelingssystemen

**CANADA** 1-800-461-3327  
The world standard professional development system

**ČESKOSLOVENSKO** 204 83026  
Světový standard mezi profesionálními vývojovými systémy

**DANMARK** 42-27 64 55  
Verdensstandarden for professionelle

**FRANCE** 1-34 65 60 60  
Le standard mondial des systèmes de développement professionnels

**DEUTSCHLAND** 06103 768-200  
Der standard in professionellen Entwicklungssystemen

**SUOMI** 941-783-344  
Ammattimaisen sovelluskehityksen maailmanstandardi

**HONG KONG** 540 4380  
The world standard professional development system

**ITALIA** 2-26.91.51  
Lo standard mondiale dei sistemi professionali di sviluppo

**日本** 0334861400  
世界標準プロフェッショナル開発環境

**台灣** 2-7186627  
世界標準的專業開發系統

**MALAYSIA** 03-230-2618  
The world standard professional development system

**NETHERLANDS** 020-540-54-00  
De wereldwijde standaard voor professionele ontwikkelingssystemen

**NEW ZEALAND** 09-360 0231  
The world standard professional development system

**NORGE** 225-3350  
Standarden innen profesjonell systemutvikling

**SINGAPORE** 339-8122  
The world standard professional development system

**ESPAÑA** 91-388 30 10  
El estándar mundial en sistemas de desarrollo profesionales

**SVERIGE** 08-799 20 00  
Standarden för professionell programutvecklingsjorden runt

**대한민국** 02 - 5512795  
전문가를 위한 개발시스템의 범세계 표준

**RUSSIA (C.I.S.)** 959217457  
Всемирный стандарт в области профессионального программирования

**UNITED KINGDOM** 0734 321150  
The world standard professional development system

**B O R L A N D**  
*The Leader in Object-Oriented Programming*

Copyright © 1992 Borland International, Inc. All rights reserved. All Borland product names are trademarks of Borland International, Inc. For Borland product information, contact: Japan 0334861400; United States (408) 438-8400; Latin America: Argentina (Softland S.A.) 54-1-354-271; Brazil (A-T Software) 55-11-283-0355; Bolivia (Merisel Latin America) 305-599-7020; Caribbean (Merisel Latin America) 305-599-7020; Central America (Merisel Latin America) 305-599-7020; Chile (Success) 56-2-393-951; Colombia (LASC Ltda) 57-1-256-1536; Ecuador (Merisel Latin America) 305-599-7020; Mexico (Siga Desarrollos) 52-5-687-7582; Paraguay (Merisel Latin America) 305-599-7020; Peru (Merisel Latin America) 305-599-7020; Uruguay (Merisel Latin America) 305-599-7020; Venezuela (Tecno Praxis) 58-2-242-0644 - BI 1537A

**Circle 367 on Inquiry Card (RESELLERS: 368).**